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ABSTRACT

This study examined college students' perceptions of course Web sites as an instructional resource for classroom-based courses. The focus was on identifying functions on the sites that students perceived as supporting and fostering their learning experiences. Subjects were 142 students responding to a 60-item questionnaire and open-ended questions. Findings indicated an overall positive perception of the quality and usefulness of the course Web sites. On average per typical semester week, 64 minutes were spent on conducting searches on the Web, 40 minutes on downloading and printing material, and 34 minutes on communicating with faculty and teaching assistants. Highest ratings of instructional quality were on the visual appeal and readability of sites and the importance of the material on the site. Lowest were on the clarity and purposeful introductions to each segment on the site, clarity of the connection of each new section on the site with course objectives, and general taste in color of the pages. Highest ratings for perceived usefulness were on the use of visuals to recall or present new information and the opportunity to ask questions online. Lowest were the use of links to review/recall prerequisite material and instruction on how to navigate the site. Greatest barriers to use were access to computers and to Web site addresses, perceived in adequacy of their Internet skills, motivation to use the site, and time constraints. Greatest facilitators of use were guidance, quality of content, availability of material, access to material, faculty, peers, teaching assistants, experts, and ease of communication. Overall impact of course Web sites was time saving qualities, 24-hour accessibility to resources, facilitating preparation for class, and increased understanding of class expectations and objectives. There appeared to be a negative relationship between residential distance from campus and perceived usefulness of sites and a possible relationship between courses and students' perceived instructional quality on functions related to clarity of purpose and objectives. Also, there appeared to be a general lack of motivation to use the sites, possibly due to their lack of mandatory use and what students reported as a lack of incentive to use them for specific course requirements. (AEF)

Integrating WWW Technology into Classroom Teaching: College Students' Perceptions of Course Web sites as an Instructional Resource

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Dissertation

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Approved:_____

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Dissertation Abstract

The purpose of this study was to examine college students' perceptions of course Web sites as an instructional resource for classroom-based courses as one case study of a private Research II university faculty initiative to integrate WWW technology into campus-based courses. The focus of the study was on the identification of functions on the course Web sites that students perceived as supporting and fostering their learning experiences.

One hundred and forty two students responded to a 60-item questionnaire on the time spent using their respective course Web sites, their perceptions of Web site instructional quality and usefulness. Students also responded to open-ended questions on their perceived barriers to and facilitators of using the course Web sites and their overall perceived impact of the WWW on their learning experiences. Nine out 174 course Web sites offered in the fall 1998 were selected based on a screening test using a 30-item instrument. In addition to the Student Web site Perception Survey (SWPS) and the Web site Instructional Design Checklist (WIDEC), a third instrument was developed and administered to participating faculty for triangulation purposes when interpreting the data.

Study findings indicated an overall positive perception of the quality and usefulness of the course Web sites. In terms of time spent on given functions, on average per typical semester week, 64 minutes was spent on conducting searches on the WWW, 40 minutes on downloading and printing material, and 34 minutes on communicating with faculty and teaching assistants. The highest ratings of instructional quality were on the visual appeal and readability of Web sites and the importance of the material on the

Web site. The lowest ratings of instructional quality were on the clarity and purposeful introductions to each segment on the Web site, the clarity of the connection of each new section on the Web site with course objectives, and the general taste in color of pages. The highest ratings for perceived usefulness were on the use of visuals to recall or present new information and the opportunity to ask questions online. The lowest ratings were the use of links to review/recall prerequisite material and instruction on how to navigate the Web site.

Students reported that the greatest barriers to use were access to computers and to Web site addresses (URLs), perceived inadequacy of their Internet skills, motivation to use the course Web site, and time constraints. The greatest facilitators of use were guidance, quality of content, availability of material, access to material, faculty, peers, teaching assistants, and experts, and ease of communication. Overall impact of course Web site was its time saving qualities, 24-hour accessibility to resources, facilitating preparation for class, and increased understanding of class expectations and objectives. Finally, there appears to be a negative relationship between residential distance from campus and perceived usefulness of course Web sites and a possible relationship between courses and students' perceived instructional quality specifically on functions related to clarity of purpose and objectives. In addition, there appears to be a general lack of motivation to use the course Web sites, possibly due to their lack of mandatory use and what students reported as a lack of incentive to use them for specific course requirements. Recommendations and suggestions for further research are also provided.

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A Dedication

In loving memory of my father
My mentor, inspiration, and best friend

&

In honor of my mother

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The journey one commits to in earning a doctoral degree is one that brings to my recollection an Arabic proverb: " Choose your companion before you map out your journey." I am blessed to have been accompanied by so many distinguished people, without whom this journey would not have been so enriching, if at all undertaken. There are some very special people to whom I have much gratitude. I'd like to begin with my dissertation committee members: Dr. Chuck Spuches, my dissertation advisor, for his support, encouragement, and constructive feedback; Dr. Nick Smith, who challenged me to realize my potential and enabled me to experience the hardships and rewards of the research "process"; and Dr. Gerald Edmonds who generously shared his knowledge and expertise and saved the day when computers ruined my work.

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CHAPTER ONE

Problem Statement

As intellectual capital becomes recognized as the asset of the future, universities will begin to realize that their most important asset is the student body and the university work-force, not only the faculty, but the entire work-force. The university is after all a learning environment, and the capital of the university is the knowledge, skill, and intellect of the work force. The product is an essential service, and the clients are the students (also often members of the workforce), government, community, corporations, and the nation. (Mauch, 1998, p. 12).

1.1 Introduction

Dissatisfaction with the educational status quo, both from inside and outside the university, has increased the pressure on higher education to reevaluate its traditional educational practices. Higher education is facing the challenges of the rapid advancement of information technology, increased accountability for quality education, competition from online institutions, rising costs, and changing student population (Ehrmann, 1995; Guskin, 1994; Handy, 1998; Owston, 1997).

Consequently, some universities and colleges are considering several restructuring solutions. Some of these solutions target educational practices: modifications in mission statements urging better preparation of students for work and life skills (Handy, 1998); curricula re-design with emphasis on measurable learning outcomes (Diamond, 1997); a re-definition of pedagogical goals toward a more learner-centered pedagogy (Collis, 1998); and heavy investment in technological innovations; such as the Internet (Owston, 1997). Of these solutions, the latter has received much attention in higher education literature. Administrators have high expectations that the potential of the Internet can be realized to better serve higher education clientele (Duchastel, 1997) and, thereby, address some of its restructuring concerns (Ehrmann, 1997a; Guskin, 1994; Owston, 1997). Reasons for such expectations arise from several factors.

First, the Internet's communication capabilities and its ability to transmit and store vast amounts of information hold great promise for the restructuring of teaching and learning practices. Already, two of its most popular services, Electronic mail (e-mail) and the World Wide Web (WWW/ Web[1]) are changing teaching and learning practices since "teacher and text" are no longer perceived as the only resources available to learners. Today, e-mail allows for access to global peers, colleagues, experts, and researchers. Similarly, the WWW brings a variety of multi-media resources to the fingertips of students at a speed and quality of transmission never experienced before through networked computer technology.

The 1999 Campus Computing Project's annual national survey of information technology in higher education reported that many higher education institutions were providing more services through the WWW. For example, more than half (69.5%) of the institutions responding provided online undergraduate applications on their Web sites. More than three-fourths (77.3%) made the course catalog available online. A quarter (25%) of the institutions made library-based course reserve readings available online and almost a half (46.5%) offered one or more full college courses online via the Internet and the WWW (Campus Computing Project, 1999).

Second, the Internet allows for greater adaptability of instructional methods to different learning environments making it ideal for distributed learning systems capable of accommodating the academic needs of a diverse adult student population.

In particular, adult students with work and family responsibilities, who do not have the luxury of attending school on campus, are able to have access to faculty and resources provided by the traditional educational institutions through this medium. Trend setting

[1] The WWW and Web will be used interchangeably throughout the document.

models, such as for-profit universities, virtual universities, and corporate partnerships are taking advantage of this technological potential. Examples of the for-profit models are the University of Phoenix that has no full-time or tenured faculty and the International University that has a mere seven employees and 600 students (Oppenhimer, 1997). Examples of the corporate partnerships are Motorola and Northwestern University, American Express and Rio Salvo Community College, and NYNEX and State University of New York (SUNY) (Mauch, 1998).

The co-operation between universities and businesses is predicted to become essential in the near future to provide and ensure modern and relevant education and training (Mauch, 1998). Already, several of these corporations are granting degrees themselves, or in connection with universities and colleges. Moreover, virtual universities have no physical campus and, with faculty located world-wide, they can provide increasing accessibility to learning and to a much more diverse group of academic specialists (Harasim, Clavert, & Groeneboer, 1997; Owston, 1997). The above mentioned organizations make strong claims that they are taking advantage of the new technologies and are meeting students' educational needs (Burdman, 1998a).

Third, traditional classrooms in higher education have been criticized for inadequate training of students for the work place. The boredom, seeming lack of personal attention, outdated class material, and inadequate sensitivity to a diverse population are some of the issues that have been questioned (Gardiner, 1997; Handy, 1998).

To further complicate matters, it has been argued that many students graduate without mastering core skills (Diamond, 1997). Meanwhile, state-of-the-art technologies are being adopted by corporations who are spending billions of dollars annually on formal

training to make curricula and teaching methods more relevant, interesting, and modern (Mauch, 1998). Such possibilities are forcing the traditional establishment and administration of higher education to re-think and re-structure some of its teaching and learning practices to be able to compete within a changing supply and demand equation.

Consequently, the above-mentioned pressures and challenges leave few options for higher education but to jump onto the technological bandwagon (Sherritt & Basom, 1997). Similarly, Rossner and Stockley (1997) summed up the situation as one of:

> ...increasing public access to information technology, government funding priorities for initiatives that support the development of distributed learning networks, increasing competition for students who no longer need to be present on a university campus, and the need to provide cost-effective, high quality education to greater numbers of students. (p. 333)

It is not surprising, therefore, that an intellectual debate has been brewing in higher education. Administrators have to contend with the pressure to integrate technology as a means of attracting student applications and faculty either rejecting its imposition onto their teaching practices or seek support for technology integration (Campus Computing Project, 1999), rewards, and recognition for the time and effort that goes into such efforts. Green (1999) reported that the 1999 survey of college faculty from UCLA's Higher Education Research Institute (HERI), which provides the first large-scale data on some aspects of the way college faculty use -- and do not use -- IT resources documented that "keeping up with information technology" is a major source of stress for fully two-thirds of the professoriate. (p3).

In the midst of all these re-structuring efforts, it is the students who are facing the reality of a changing educational experience. Very few educational scholars have paid attention to the experience of the students who already use the WWW. In addition to students who rely on distance education served by the proliferation of online curricula, campus-based students are also becoming attracted to the "online" experience, not only for entertainment and personal purposes, but also for academic purposes. For example, at the University of Colorado at Denver, 80% of students enrolled in one university online course, intended to boost its adult education program, were on-campus undergraduates (Burdman, 1998a). It was reported that the students preferred the convenience of logging on at midnight to waking up for an 8:00 a.m. class. However, even students who do not register for online courses may find themselves, on the first day of class, being directed to a course Web site intended to "support" and "enhance" their traditional course. Through this medium, students are told that they can log on, download class notes, view important class resources, complete assignments, receive feedback, and even take a quiz, all at their own convenience.

However, they are not necessarily informed that this convenience comes at a price. Many students find that if they do not own a computer, they probably have but two choices: either wait in line in over-crowded computer clusters or purchase the computer hardware necessary to fully participate online. Further, this proclaimed "convenience" may be hindered by additional costs accrued to related services.

In fact, the 1996 annual Campus Computing Project survey revealed that a third of all campuses (31.8%) required a student technology fee (Campus Computing Project, 1996b). In addition to concerns for cost and time constraints, the quality of students

learning experiences may be compromised by inappropriate use of WWW technology. These changes should be documented from a student's perspective and not restricted to educators' and administrators' so that technology integration efforts better serve teaching and learning practices.

1.2 Background and Problem

Though greeted with enthusiasm by the university community at large, technological integration efforts remain controversial. Opponents caution against hasty and ad hoc technology integration into the daily practices of teaching and learning, specifically without taking into consideration faculty and student willingness and cooperation in the integration efforts (Noble, 1998; Schrage, 1998; Turoff, 1997; Young, 1998). Because the integration of various technologies into teaching and learning practices arrives with such great expectation (Brown, 1998), we may be blind to the consequences of those very expectations. For example, students may expect that, because they e-mail faculty at all times of the day that, faculty will respond in a like manner. Administrators may expect that WWW technology can be designed and maintained easily and so they may not take technological integration efforts into account when making decisions about faculty reward, tenure, and promotion (Campus Computing Project, 1996b). Faculty may be expected to keep abreast of software innovations, in addition to their scholarly specialties, to enhance their teaching practices. Rarely appreciated is the time and effort that both faculty and students invest in learning how to use various technologies.

Over the past two years, we have witnessed controversial reactions to WWW technology integration efforts. For example, in the summer of 1998, 850 faculty members from the University of Washington signed a letter to the Governor protesting the possibility

of instructors being replaced by computerized teaching tools (Monaghan, 1998). A year earlier, during the summer of 1997, the University of California at Los Angeles (UCLA) created Web pages for nearly every undergraduate course, although it did not mandate their use (Young, 1998). Apparently, this initiative was launched during the summer when many faculty were away, despite the formal student recommendation against it (Noble, 1998). Faculty complained that this type of approach was 'heavy-handed' and argued that not every course benefits from the Web (Young, 1998). Furthermore, some faculty members considered such actions by the administration as an infringement on faculty academic freedom by putting an unwanted teaching tool in their courses (Young, 1998). Meanwhile students, who were required to pay fees for such Web sites, argued that many of these Web sites were not worth the fee they were paying (Young, 1998). Earlier, during the spring of 1997, the faculty at York University, Canada's third largest campus, ended a two-month-long strike after having secured a contractual protection against that type of administrative action that was taken later by UCLA (Noble, 1998). Noble, leader of the faculty strike at York University, stated that the strike was in response to:

> ...unilateral administrative initiatives in the implementation of instructional technology, the most egregious example of which was an official solicitation to private corporations inviting them to permanently place their logo on a university online course in return for $10,000 contribution to courseware development. (1998, p.2)

Noble (1998) maintained that, in a fashion similar to UCLA's, "the initiatives of the York administration in the deployment of computer technology in education were taken without faculty oversight and deliberation, much less student involvement" (p.3).

Significantly, at both UCLA and York, the somewhat presumed 'satisfied and happy' students have given clear indication that they are not so optimistic about the prospect of a high-tech academic future (Noble, 1998). These students recommended against the initiative at UCLA and at York, provided support to striking faculty, and launched their own investigation into the commercial, pedagogical, and ethical implications of online educational technology (Noble, 1998). In spite of that, UCLA officials were highly optimistic regarding students' enthusiasm about the high-tech agenda. Noble described the consequences as follows:

> To date, however, there has been no such demand on the part of students, no serious study of it, and no evidence for it. Indeed, the few times students have been given a voice, they have rejected the initiatives hands down, especially when they were required to pay for it. (p. 10)

While the UCLA initiative was met with much resistance, there was a positive side to the story reported by Young (1998). For example, several professors welcomed the program with the rationale that it gave them the support they needed to try new things, enhanced the computer level of competency among colleagues and students, and allowed for easier distribution of materials to students. Professors of the sciences, it was reported, expressed more comfort with the WWW than those in the humanities. Students also expressed some positive reactions to the program. For example, several students liked the convenience of accessing information during early morning hours and receiving timely feedback from their course instructors. Other students appreciated the quality of information made available in various modes of presentation be it pictures and examples for a particular unit or program information on a given course to be offered in the following

semester. Young (1998) also reported that a survey of 4,000 students conducted by the university in the fall of 1997 revealed that 60% of students felt that the WWW pages had increased their interaction with professors. It is not surprising then that UCLA officials, as reported in a different context by Noble (1998), "would insist that faculty make fuller use of the Web site technology in their courses" (p. 10).

In sum, the Internet is being heralded as a versatile medium to support learner-centered educational practices. It is being promoted as a technological innovation that can reduce mundane time-consuming tasks of faculty workload. However, there is evidence for discontentment and controversial opinions regarding the above from both faculty and student bodies that only time and empirical research could serve to dispel. This study seeks to voice students' opinions based on the belief that in a student-centered educational institution such as the case represented in this study, students should participate in the decision-making process related to WWW technology integration efforts by voicing the impact of the changes they confront.

1.3 Study Purpose and Research Questions

The purpose of this study was to examine college students' perceptions of their course Web sites as an instructional resource for classroom-based teaching at Syracuse University, a private university classified as a Research II university (Carnegie Classification - Directory of Higher Education, 2000) located in the northeast of the United States. The focus of the study was on the identification of functions on their course Web sites that students perceived as supporting and enhancing their learning experiences. This study therefore explored the time students spent using the course Web sites, as well as their perceptions of the instructional quality and usefulness of these functions. Study findings

also contributed to closing gaps in empirical research on Web-based instruction pertaining to student use of various Web site functions for instructional purposes, the usefulness and quality of these functions, and the conditions that promote or inhibit learning using Web technology. Since these issues from a student perspective were hardly examined in prior research the following questions were posited to achieve the purpose of the study:

1) How did students allocate their time using their course Web sites?
2) What was the quality of the course Web sites according to the students?
3) How useful did students perceive their course Web sites?
4) What demographics and characteristics influenced students' use and perceptions of quality and usefulness of course Web sites?
5) What were some student reported barriers to and facilitators of use of the course Web sites and overall impact of the WWW on students' learning experiences?

1.4 Theoretical Framework

A conceptual framework was developed to ground and guide the research conducted in this study. Figure A illustrates this conceptual framework. There is evidence from research findings that certain principles exist in most successful teaching and learning practices (Chickering and Gamson, 1987, 1991). Second, there is evidence in the literature that the application of instructional design principles to teaching and learning practices leads to more effective learning (Gagné 1975, Gagné, Briggs, & Wager, 1992). One of the important measures of effective instruction is how students feel about the instructional process (Dick & Reiser, 1989). Based on the above premises, one can make the assumption that a well-designed instructional Web site can *support* and *foster* good

teaching and learning practices and therefore become a valuable instructional resource for both faculty and students.

This framework illustrated in Figure A depicts the scope and theoretical context of the study. In this framework, the two foci are (a) the course Web sites and (b) students' time on task and their perceptions of the quality and usefulness of Web site functions (outcome measures). The course Web sites sampling pool is studied using two sets of theoretical principles. The first is Gagné, Briggs, and Wager's (1992) set of nine events of instruction (hereby referred to as the nine events). Gagné et al.'s (1992) nine events of instruction are considered essential elements to effective instruction (Richey, 1996; Richey, 2000; Ritchie & Hoffman, 1996; Smith & Ragan, 1996).

INSERT FRAMEWORK

The second set of principles is Chickering and Ehrmann (1996) conceptualization of the seven principles developed by Chickering and Gamson (1987, 1991) and placed in a technology-based context whereby various technologies are used as a lever to promote these good practices (hereby referred to as the seven principles). All principles but two were relevant to the scope of the study. Principle 6, communicating high expectations and principle 7, respecting diverse ways and talents, while highly important, were believed beyond the scope and timelines of the study and were therefore excluded.

Moreover, functions presented by the course Web site were measured using the two sets of principles mentioned above. They were also presented to students as the criteria of evaluation of their course Web sites and were the basis for item development in the study instruments for data collection (see section 2.6, 3.6.2, and Appendix B and C for instruments). Figure A further illustrates the focus of the study as four outcomes measures: (a) use as indicated by time on task; (b) usefulness; (c) quality; and (d) factors that influenced the first three outcomes. It is important to note that the author is aware that this conceptual framework is by no means a comprehensive or accurate representation of the reality. It is only intended to simplify the complexity of the inter-relationships between the variables under study. These measures are studied within two units of analysis: (a) the course Web sites and (b) student characteristics and demographics. Demographics and characteristics include: student Internet expertise, computer accessibility, years of accessing the WWW, GPA, gender, academic discipline, reasons for taking the course, proximity of residence to campus clusters, modem speed and connectivity, among others in Figure A. These variables were selected based on narrative data gathered from ten one-hour interviews with students taking one of the courses represented in the sample. These

variables also draw upon the learning environment at Syracuse University and there are relevant contextual factors to examine to support and explain findings from the quantitative data. The theoretical framework depicted in Figure A is further discussed in section 2.6 in chapter two.

Traditionally, in the field of educational technology, demographics variables have been examined in relation to technology use to test hypotheses related to learning achievement. This has lead to ongoing debates about significant versus non significant findings in comparative studies between online education and traditional education on student achievement measures, for example, studies by Chen, Lehman, & Armstrong (1991); Despain (1997); Efendioglo & Murray (2000); Fulmer, Hazzard, Jones, & Keene (1992); Hammond (1997); Martin & Rainey (1993); Morrissey (1998); Nesler & Lettus (1995); Schutte (1998), and Stinson & Claus (2000). In this study, however, the purpose of studying these variables is simply to situate the study findings in a familiar context where the phenomenon occurs, i.e., within one larger case study of a private university with those particular student demographics and characteristics. The second purpose is to provide possible insights in interpreting the findings rather than to add to the significant versus non-significant debate or to test the hypothesis that "increased" learning has occurred using the new technology.

In summary, Gagné's et al. (1992) nine events of instruction and Chickering and Ehrmann's (1996) seven principles of good teaching and learning practices using technology as a lever were selected to serve as a conceptual framework and a source of theoretical grounding for the study to be drawn upon in the construction of outcome measures of what students value about the WWW when used to support classroom teaching

and learning functions. Specifically, the theoretical framework served to operationalize three dimensions used in this study: *Time Spent* as an indicator of course Web site use, *Instructional Quality*, and *Usefulness*. These dimensions guided instrument development to be presented in chapter three. Moreover, the findings should add to a growing body of literature on optimal use and integration of WWW technology to improve teaching and learning experiences. Second, the findings should provide empirical research for the applicability of these two theoretical frameworks in a Web-based context. Third, the findings should provide insights into functions, when present, are perceived valuable to a student using this site as a resource to enhance his/her learning efforts.

Various instructional design models and theories were considered for adoption by this study. Given that the focus of the study was to identify what Web site functions students perceived as supporting and enhancing their learning experience, a theoretical model that explicitly defines the elements of instructional sequencing and support was required. A model was determined necessary to suit the purpose of developing some evaluation criteria for Web-based instruction given the difficulty in finding explicit theory-driven instructional Web site evaluation criteria in the related literature.

Several relevant traditional and constructivist models were examined such as *Madeline Hunter's Elements of Lesson Design* (Hunter, 1967), *Bloom's Taxonomy of the Cognitive Domain* (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), *the Direct Instruction Model* (Joyce, Weil, & Showers, 1994, as cited in Driskell, 1999), *the Constructivist Learning Environments* Model (Honebein, 1996, as cited in Driskell, 1999), and *the Web-based Instructional Design Model* (El-Tigi & Branch, 1997). However, none were found to be as elementary, encompassing, generative, and applicable to the

development of a set of evaluation criteria as the nine events (see section 3.5 for instrument development).

1.5 Significance of the Topic and Study

Educational institutions require better information about the consequences of current educational uses of various technologies (Ehrmann, 1997a). Research findings contribute to a growing body of research that supports decisions on WWW technology integration specific to campus-based classes. As more and more organized instruction is delivered on the WWW, and as students gain more access to the Internet, its effective utilization and integration into their learning experiences becomes more crucial.

The rapid growth of Internet use in higher education augmented by the various economic, political, and social pressures on higher education to integrate networked technologies in the classroom are the primary driving forces behind the changes in today's learning environment. This learning environment must cater to global job market skills and knowledge that depend heavily on cutting edge technologies for communication and trade (Guskin, 1994; Romiszowski, 1997; Owston, 1997). One rationale is that one key to improved learning with the Web lies in effective utilization of this medium in teaching and learning (Owston, 1997).

Similarly, as we witness changes in student demographics, occupational requirements, the rising tuition costs and decreasing student enrollments in some traditional campus-based courses, the argument for distributed learning environments, in the form of Web technology for instructional support purposes, grows stronger. The Internet emerges as one technological solution to an educational challenge. It also forces traditional education toward re-engineering and re-structuring itself to meet the needs of its clientele.

This study seeks to give voice to a large segment of higher education's clientele, namely the students.

Delivering instruction using the WWW, like any other instructional design effort, requires detailed analysis of user interaction, appropriate selection and optimization of various media capabilities, and implementation of sound instructional design principles in order to provide high pedagogic value to students (Gagné, Briggs, & Wager, 1992; Dick & Carey, 1996). This necessitates a closer examination of the student population that will be most affected by technology integration efforts. In higher education settings, students are the primary consumers and users of Web technology and the primary target audience of course Web sites. Hence, documentation of their opinions, attitudes, and first-hand experiences with instructional course Web sites constitutes significant feedback to the instructional design effort and the establishment of good teaching and learning practices.

Exploring some dimensions of the current use of instructional course Web sites serves to contribute to research studies that address fundamental questions that loom large in the literature; for example, questions like the ones posited by Windschitl (1998) on the pedagogic value of the WWW asking: (a) Are WWW-based practices helping students, and if so, how?" and (b) How is the introduction of this technology changing pedagogical practices?" or evaluation questions on Web-based instruction such as those identified by Trochim (1996): (a) How are students using course Web sites? (b) What features are most effective for learners? and (c) How best can we evaluate learning features contained on Web sites?

Hence, this study focused on examining students' perceptions of course Web sites as an instructional resource, specifically students reported time on task, and the usefulness

and instructional quality of various functions. Students also reported on the WWW impact on learning as well as barriers to and facilitators of course Web site use. In addition, conditions that influenced these perceptions were also explored with particular emphasis on some student characteristics and demographics. Indeed, as far back as 1995, Schrum stated, "It is timely to study these (online) courses now so that educators can take a strong leadership role in assuring that courses are pedagogically sound, organizationally strong, and institutionally supported" (1995, p. 1). Schrum, also advocated that learners be given a larger role in the design of online courses. One way to contribute to this goal would be to take into account students' perspectives on instructional solutions using functions supported by Web technology that they consider useful and facilitative of their learning experiences.

1.6 Dissertation Organization

This dissertation is organized into six chapters, with this chapter as the introductory chapter stating the problem, purpose, focus and theoretical grounding of the study. Chapter two is a review of relevant literature covering current controversy about use of technology in higher education and justification for such use. The chapter also describes the technology and some of its perceived benefits and limitations. Chapter three outlines the methodology for the study and includes a brief contextual overview about WWW technology integration at Syracuse University. Descriptions are given of the participants, design methods, data collection strategies, variables included in the study, and statistical and qualitative analysis procedures employed. Chapter four describes the design, development, and validation of the Student's Web site Perception Survey (SWPS). Chapter five presents the results of the study in both narrative and tabular formats. The

final chapter, chapter six, summarizes the study and its limitations. Methodological, theoretical, and practical implications are discussed. In addition, conclusions drawn from this research as well as suggestions for future research bring this thesis report to closure.

1.7 Chapter Summary

This study investigated the extent to which higher education students valued their course web sites and the factors that influenced those perceptions. The study draws upon a theoretical framework for study design and implementation. Findings from the study provide empirical data to better inform decision-makers with regard to current teaching and learning experiences when using WWW technology as an instructional resource to support classroom based teaching. [A glossary of terms is provided in Appendix A]. Figure C provides a pictorial overview of the study is located at the back of this document for convenience (see page 229). Chapter two presents relevant research including empirical research findings on the presence of the Internet/WWW in higher education, the history of the WWW, a definition and typology of Web-based instruction (WBI) including empirical research on WBI. Finally a discussion of the nine events of instruction and the seven principles of good teaching and learning practices brings the chapter to closure.

CHAPTER TWO

Review of Relevant Literature

"It is not simply a matter of 'using' new technology for old familiar purposes, but of finding that those purposes change, that the way we think and feel about them change, that new purposes and new needs come into being that barely existed before" (Burbules, 1996, p.21).

2.1 Introduction

The chapter outlines various perspectives related to both the challenges and the possibilities that can be afforded by the Internet/WWW in a teaching and learning environment. The chapter begins with a broad summary of the larger economic and societal pressures on higher education to use the Internet. The discussion of the literature continues as follows:

- The Presence of the Internet/WWW in Higher Education
- The World Wide Web
  - History and Characteristics
  - The World Wide Web as a Distributed Learning Environment
- Web-based Instruction
  - A Definition
  - A Typology of Course Web sites - WWW Technology Integration
  - Highlights on Web-Based Instruction (WBI) Research
- Effective Instruction - Theory and Practice
  - Gagné's Nine Events of Instruction

- Application of Gagné's Nine Events of Instruction to Determine the Quality of an Instructional Web Site
- The World Wide Web as Lever to Teaching and Learning Practices
- Seven Principles of Good Practice in Undergraduate Education
- Chapter Summary

2.2 The Presence of the Internet/WWW in Higher Education

The National Center for Education Statistics (NCES) published a statistical analysis report on the status of distance education at postsecondary education institutions in a survey conducted during winter 1998-1999 (Lewis, Snow, Farris, & Westat, 1999). It was reported that 78 percent of public four-year institutions (19% of private 4-year institutions) offered distance courses. It was also reported that over 54, 000 college level, credit-granting distance courses were offered by 2-year and 4-year postsecondary institutions during 1997-1998. By 2001, if the current trend continues, it was anticipated that most universities large or small, public or private will likely offer one or more courses online. The primary mode of instructional delivery is the Internet, used by 58% of all institutions utilizing its asynchronous computer-based capabilities (Lewis, Snow, Farris, & Westat, 1999).

The growth in distance education and use of the Internet has made its mark on campus-based higher education. This mark becomes evident upon examination of the Campus Computing Project (CCP) annual survey findings over a span of six years. CCP data are revealing the extent of use of information technology in higher education in the United States. The CCP survey is the largest continuing study of the role of information technology in US higher education (CCP, 2000). Every year, Campus Computing officials

at 550 to 800 two- and four-year colleges and universities participate. The author summarized the relevant survey findings pertaining to the status of information technology (IT) in higher education over a period of 6 years (1994-1999).[2] Earlier reports were excluded because they were conducted prior to the presence of the Internet in higher education.

Each year, the report sought to highlight the status of IT in higher education. The 1994 survey report highlighted IT as moving slowly into the classroom (Campus Computing Project, [CCP] 1994). Officials reported that "expanding or enhancing 'network access' remains a top priority " (CCP, 1994, p. 2). Demand by Internet users from traditionally non-technology related disciplines increased. Consequently, expanding campus networks remained the top priority. By 1994, 79% of the campuses had Internet access.

The 1995 survey findings highlighted a dramatic growth in the use of IT in college courses (CCP, 1996a). In addition to the use of e-mail, CD-ROM, computer simulations, the use of the Internet and the WWW also increased. The data also revealed that the use of information technology in instruction was breaking into the ranks of mainstream faculty as opposed to just the early adopters (Green, 1996a).

Students' expectations for integration of technology in their courses, across all disciplines, were increasing and so were faculty efforts to integrate technology into the curriculum. For example, more than 14% of all campus classes put class materials, such as syllabi, on the Web. More than 24% use other Web resources, such as online encyclopedias and other Web sites. The data also revealed that "the Internet and WWW

[2] Dr. Kenneth Green, director of the project informed me that a trend report of the past 10 years will be published by the end of this year (personal communication on Feb 18th, 2000).

access are viewed by a growing number of faculty and students as a core resource as well as a basic right, similar to a library card" (Green, 1996a p. 9). Already 71.5% of the respondents stated that using Internet resources was *very important* (CCP, 1996a).

The 1996 report highlighted instructional integration and user support as presenting continuing technology challenges (CCP, 1996b). This was only in response to the growing students expectations across all disciplines to integrate technology into learning and instructional experience (CCP, 1996b). Interestingly, by 1996, 30.1% of participating campuses reported a formal campus plan for the use of the Internet and the WWW in instruction.

The 1997 report highlighted more technology in the syllabus and more campuses imposed IT requirements and student fees (CCP, 1997). It was reported that "Electronic mail, the Internet, the WWW, and multimedia are increasingly common components of the instructional experience for growing numbers of American college students" (CCP, 1997, p.1). It was also reported that despite the increase in IT use and the growing number of campuses imposing IT requirements on their students, assisting faculty to integrate technology into their instruction and providing user support were among the top IT challenges confronting higher education institutions (CCP, 1997).

The 1998 report highlighted colleges struggling with IT planning (CCP, 1998). More than 60% of higher education institutions did not have an IT financial plan, under 50% had a strategic plan for IT, and 60% did not have an instructional plan for using the Internet. Again, respondents reported that assisting faculty to integrate technology into instruction was the single most important IT issue confronting their institution. (CC, 1998).

Most recently, the 1999 report highlighted the continuing challenge of instructional integration and user support (CCP, 1999). The challenges of integrating and optimizing use of such technologies were continuously reported as growing concerns for many educators. This became evident when the 1997-1999 surveys paid closer attention to the identification of the single most important IT issue in higher education. The 1997 results reported that 29.6% of all institutions considered the number one most important issue to provide assistance to faculty efforts to integrate IT into instruction. Similarly, the 1998 and 1999 results reported a continued increase of 33.2% for 1998 and 39.2% for 1999. Providing adequate user support ranked second in the 1999 survey report according to 28.2% of the survey respondents, an increase from 26.5% in 1998, and 25% in 1997.

An analysis of the 1994-1999 survey reports also shows that the use of technology in instruction has been rapidly rising. Specifically, data reported for the use of e-mail, Internet resources, and Web pages were examined over the six-year span. Table 1 summarizes the findings.

Table 1

Summary Table of Technology Use in Higher Education (in Percentages by Responding Institutions)

Variable	1994	1995	1996	1997	1998	1999
E-mail	9	20	25	32	44	54
Internet Resources	NA	11	16	25	33	39
Class Web pages	NA	7	9	15	23	28

(Adopted from Campus Computing Survey Reports 1994-1999)
Note: Percentages reported contain rounding off errors

E-mail had already been in use in 1994 rising to 54% by 1999 up from 44% in 1998, and 20% in 1995. Similarly, use of Internet resources was 11% in 1995 and rose to 39% in 1999. Similarly, the percentages of college courses using the WWW in the syllabus

rose from 7% in 1995 to 28% in 1999 compared to 23% in 1998 and 9% in 1996 (CCP 1996). The most relevant finding to this study was the growth of the use of Web pages for classroom teaching. This number quadrupled by 1999 meaning that more than one in every four classes has a Web page. In fact, compared to e-mail and general use of Internet resources, use of Web pages has shown the highest rate of increase over the six-year period.

In summary, over three consecutive annual surveys, providing assistance to faculty efforts to integrate technology into instruction, emerged as the most important issue confronting U.S. higher education in the past three years. Dr. Kenneth Green, project director, predicted that this will continue for the next two to three years (CCP, 1999). He also pointed out that for many institutions user support and instructional integration are complementary components of the broad challenge that involves the effective use of new technologies in teaching (CCP, 1999, p. 1). Interestingly, however, Green noted that the key information technology challenges in higher education involve people, not products, unlike in the past, when higher education was more concerned with building the infrastructure to support the technology. Green also observed that "what's ahead for most faculty and most students is some kind of hybrid learning experience in which technology supplements, not supplants, both the content and the discourse that have been part of the traditional experience of going to college" (CCP, 1999, p.1-2). Given the above research findings, the following section presents what some scholars envision as lying ahead for integration of the WWW in classroom teaching.

2.3 The World Wide Web (WWW/Web)

As stated earlier, the WWW is one of several services on the Internet. One definition of the Internet is a "...collection of networks that includes local area networks (LANs), dedicated computer lines, telephone lines, and satellite links" (Starr, 1997). The WWW is a world wide electronic medium for the storage, retrieval, and dissemination of linked information on the Internet. Moreover, the WWW is a graphical information provider that is geographically, time and platform independent (December & Randall, 1996).

2.3.1 History and Characteristics

Chronologically, the World Wide Web was released onto the Internet in 1991 (Zakon, 1996). By 1994, the World Wide Web was already becoming the most popular service on the Internet and with the highest traffic by 1996 (Zakon, 1996). Tim Berners-Lee, a physicist at Conseil Europeen pour la Recherche Nucleaire (CERN), proposed a hypertext project that later in December 1990 became a program known as the *WorldWideWeb* (Starr, 1997). The *LineMode Browser* was a tool developed to access Web data (Starr, 1997). A graphical user interface (GUI) was developed at the National Center for Supercomputing Applications (NCSA) and, in February 1993, became the first Web browser known as *Mosaic* (Starr, 1997). Currently, *Netscape Communicator* and *Microsoft Explorer* are the two browsers commonly known on the market.

The WWW consists of a user interface that is consistent across many computers in addition to a set of standards that enable the interface to access a variety of document types

and information protocols (December & Randall, 1996). Text that is *hyperlinked* is known as hypertext. *Hypertext MarkUp Language* (HTML) is the common language used to code information on the Web. Hypertext is non-sequential text used to store information in a network of hyperlinked nodes (Seyer, 1991). Hyperlinking occurs when text is highlighted or underlined thereby marking an attachment to another piece of information. Hypermedia extends hypertext in two ways: it incorporates multimedia into hypertext documents and allows for graphic, audio and video elements to become links to other documents or multimedia elements (December & Randall, 1996).

In summary, the WWW is perceived by many as the software choice on the Internet (Grau & Bartasis, 1995). Proponents of use of this medium highlight its hypermedia capabilities as one of its unique features in addition to its integration of various multimedia from video clips to three-dimensional images, claiming that the WWW is emerging as possibly the number one delivery medium for creative pedagogical use (Nichols, 1995). The WWW, like several other resources, provides information that can be used for teaching and learning. However, the quality, accuracy, and credibility of this information can not be taken for granted. The WWW differs from other resources in that it is has powerful features that allow users world-wide access to more abundant information on various topics through electronic databases created by people world wide and linked through hypertext, images, sound, and animation (December & Randall, 1996).

The impact of the World Wide Web on education is evident in the changing student and teacher perceptions of space and time (Crossman, 1997). According to Crossman, this change marks a new threshold in how the WWW will be used as an instructional technology resource. Historically, technologies that tend to flourish are those that are

simpler to use and have a consistent standardized format, such is the case with the WWW in that it meets the first criterion of ease of use. Similarly, the use of the hypertext transfer protocol (*http*) also meets the second criterion of consistency by virtue of being the standard form of the uniform resource locator throughout the world. Previous complex procedures have been by-passed and there is continuous development of search engines using keyword searches. In addition to the above, Crossman (1997) pointed out the unique integrated attributes of the WWW, including text, graphics, photography, full-motion color video, and high fidelity sound make it the fastest growing communication system in history. According to Romiszowski (1997)

> It [the WWW] is the latest embodiment of hypertext/hypermedia environments, allowing practical implementation and use of hypertext environments to graduate from the relatively small stand-alone systems previously developed with tools such as HyperCard or ToolBook, to much larger and universally available systems of structured information. (p.27)

2.3.2 The WWW as a Distributed Learning Environment

When a given technology fosters a communication system or environment that is independent of space, time, and location, it has the capabilities of supporting a distributed learning environment. The WWW has such capabilities in that it allows access to knowledge and information databases independent of time, distance, and location constraints. In this distributed learning context, "the WWW can be used in combination with traditional classroom-based courses, with traditional distance learning courses, or can be used to create wholly virtual classrooms" (Saltzberg & Polyson, 1997).

Furthermore, since the WWW, by its very nature, distributes resources and information, it can be used in combination with electronic mail, Telnet, Usenet Newsgroups, video-conferencing and various other Internet tools and thereby transformed into a powerful interactive environment. Through the use of this environment and such capabilities, it is claimed that the WWW becomes the most ideal medium of delivery for a distributed learning model (Saltzberg & Polyson, 1997). Given this claim, a closer examination of current efforts to use the WWW for teaching and learning purposes follows.

2.4 Web-Based Instruction (WBI)

2.4.1 A Definition

A review of current literature revealed several overlapping definitions of Web-based instruction (WBI). Currently, several references exist regarding use of the WWW in an educational context. Web-based learning (Hackbarth, 1997), Web-based instruction (Khan, 1997), Web-based training (Driscoll, 1997) and distributed-learning (Dede, 1995) are among the most frequently used terms. Barron (1998) identified several other classifications including Web-enhanced instruction; Web-managed instruction; and Web-delivered instruction. Barron pointed out that none of these arbitrary categories are exclusive (1998).

A more specific definition is that proposed by Gillani and Relan (1997) whereby Web-based instruction "is interpreted broadly as any form of instructional delivery in which the World Wide Web is included as a tool" (p. 41). This definition seeks to differentiate Web-based instruction from traditional instruction in that the latter is broadly defined as "an instructional environment which, among other characteristics, occurs within confined walls and is primarily face-to face" (Gillani & Relan, 1997, p. 41).

However, Khan (1997) provided an even more encompassing definition of Web-based instruction, which will be used for the purpose of this study.

> Web-based instruction (WBI) is a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is *fostered* and *supported* [italics added]. (p. 6)

Moreover, it is important to note that the overlap and inconsistencies, throughout research documents, in the use of terminology to describe Web-based instruction extends to the inconsistent use of terms to define the characteristics and attributes of this medium beginning with the use of the terms *Web* and *WWW*!

For example, Bannan-Ritland, Harvey, and Milheim (1998) used the term *element*s to describe an instructional categorization scheme for effective design and delivery of instruction. While the authors did not define their use of the term *elements* they did use it to define course-related logistical elements such as a syllabus, schedule, and class notes and assignments. The authors also used the term *components* for instructor-selected Web links, Web-converted presentation slides, and Web-based tutorials. In addition, the authors used the term *activities* for posting of course-related information, organization of Web resources and links, interactive on-line communication, instructional modules including presentation of information and feedback related to specific content. El-Tigi and Branch (1997) used the term *attributes* to describe Web frames, tables, and image maps which are organized hyperlinked graphical displays of information afforded by the Web. Collis (1998) used the terms *functions* and *functionalities* for activities such as posting information on the Web;

making a calendar available on the WWW; providing feedback; extending lecture by increasing various forms of communication; and test-taking and scoring.

Khan (1997), in his book entitled *Web-based Instruction* dedicated his introductory chapter to definitions as an attempt to classify and categorize the terminology. First he defined and explained the phenomenon of WBI by providing two distinct classifications a) components and b) features. According to Khan (1997) components are *integral parts* of the World Wide Web. Features are *characteristics* that are contributed by these components. Examples of the various components of WBI include: content development (e.g., instructional design and learning theories), multimedia (e.g., graphics, text, video and audio streaming), Internet tools (e.g., asynchronous such as e-mail, listservs, and newsgroups and synchronous such as Chat, IRC, MUDS), and hardware and software (e.g., computers, browsers, authoring programs, connection and service providers, and servers).

Web-based features are represented as attributes that are conducive to learning and instruction. Key features include: the interactive nature of the medium, its global accessibility, distributed open system, and on-line searching. Additional features include: convenience, self-contained; non-discriminatory; cost-effective, environmentally friendly, and collaborative learning. In addition, Khan uses the term "components" to include a wide range of integral parts such as content development, multimedia, and tools.

Second, Khan (1997) used the term elements when referring to entities of a component. Within the multimedia component for example, are smaller elements such as color, graphics, pictures, animations, text, navigational buttons, sound, music, and italicized, bolded, highlighted, and blinking text (personal communication, February 14th, 2000). Khan's classification is one way of synthesizing the various characteristics of the

World Wide Web when used in an academic setting. It is by no means an exhaustive classification and may require further modification as the WWW continues to evolve and WBI reaches maturity. However, it is one of the few, if not the only, attempt to define certain terminology emerging in the literature related to Web-based instruction. In sum, it is important to note that the literature, like in the overlap of the definition of WBI, also has not reached a consistent use of terminology to describe the above.

In addition to Khan's (1997) definitions and usage of the terms described above, in this report, the term *functions* is used to describe ways in which the WWW can be used for teaching and learning purposes. These functions encompass user actions such as searching the WWW to access reference materials; downloading/printing information from the course Web site; viewing a multi-media presentation/lecture; and communicating with the course instructor/ Teaching assistant(s). Furthermore, while Khan (1997) did not define those two terms, this author uses the term *support* in reference to instructional design efforts that contribute to the integration of WWW technology to create useful learning environments and include various instructional functions such as interaction, presentation, practice, guidance, elicitation, feedback, and assessment. *Foster* refers to the provision of various learning opportunities that provide remediation and enrichment to students' learning experiences.

2.4.2 Typology of Course Web sites – WWW Technology Integration

Currently, there are hundreds of educational Web sites. In higher education, numerous Web sites are developed to complement the curricula. There are hundreds of examples of faculty delivering their instructional materials on the WWW, the *World Lecture Hall* provides numerous course Web sites in over seventy five academic areas and

is available at http://wwwhost.cc.utexas.edu/world/instruction/index.html. *The WWWDEV Members' Course List* available at http://www.unb.ca/web/wwwdev/c3.html is a second example of directories listing courses from all over the United States. At a university level, the *Syracuse University Faculty Syllabus Web site* available at http://syllabus.syr.edu is an example of a growing list of campus-based course Web sites. Classification of these creations takes a variety of forms.

Generally, course Web sites such as the above listings are offered in varying contexts to a diverse student population. A review of the literature resulted in finding very few attempts to provide a typology of use of the WWW for educational purposes. For example, The E*ducational Technology Special Issue* dedicated to Web-based learning (Hackbarth, 1997) had only one article (out of nine articles) that attempted to classify these emerging Web sites. Quinlan (1997) described some of these educational Web sites as student-generated projects while others are subject-oriented syllabi of course material. Similarly, in *Web-based Instruction* (Khan, 1997), besides the editor, only Butler, provided a conceptual framework for categorizing uses of the WWW in the classroom (1997). Butler identified three ways of using the WWW in the classroom: (a) as a tool for bringing the world to the classroom, (b) as a tool for supporting classroom activities, and (c) as a tool for opening the classroom to the world.

In 1998, the *Paul Allen Foundation* sponsored a virtual education contest for the most outstanding online course. A total of 182 entries were received from 148 institutions. These entries were judged by a panel of experts in educational technology (Kearsley, 1998). Some salient characteristics of these courses were described by one of the expert panelists, Dr. Greg Kearsley in an article reporting the criteria used to identify the most

outstanding online courses. Several categories were identified to describe the most salient characteristics. These categories were more detailed and inclusive than any other previous attempts that the author is aware of. These categories are further described below:

The salient characteristics of the 182 course Web sites were primarily categorized into: (a) course components, (b) relationship to onsite instruction, (c) pedagogy, (d) course development, and (e) student assessment. A wide range of what constitutes course Web sites were described by Kearsley (1998) as course components follows:

> Courses involved various combinations of these components, ranging from an online syllabus and use of mailing lists to full-fledged sites with lectures using streaming audio/video, chat rooms, conferences, and extensive quizzes or problem sets. Online course materials ranged from static documents (perhaps illustrated with graphics or photos) to highly interactive by virtue of links to other Web sites, animations, simulations, or exercises with feedback. Archives of student work could be completed assignments (often published as Web pages) or responses to questions from online conferences. It should be noted that successive versions of online courses tend to include more interactive components as instructors become more comfortable with online teaching and Internet capabilities. (p. 2)

Relationship to on-site instruction varied among the courses from those that were supplements for traditional on-site classes to those that were totally online with no on-site regular meetings. The totally online courses included online final exams. *Pedagogy* reflected in the course entries ranged from traditional didactic with lecturing as the primary method of instruction, to novel discovery and problem-based learning methods. Overall, there was emphasis on student participation and group interaction thereby employing active

learning techniques. Other than this emphasis, the instructional strategies and methods employed were reported to be similar to traditional course design (Kearsley, 1998).

Course development ranged from those created solely by a single instructor on his/her own initiative, to those developed by large teams with institutional resources and support. Kearsley (1998) further elaborated:

> Most courses appear to be developed by a small team of two or three people, generally an instructor with help from a colleague, designer/programmer, or student assistant. Some courses and web sites were created from scratch using HTML editors whereas others were developed in the context of web authoring systems and services such as TopClass, Lotus Notes/LearningSpace or Real Education. Courses that involved chat or forums typically used commercially available packages such as WebCT, WebBoard, or NetMeeting. For multimedia materials, Shockwave, Acrobat, and Real Audio/Video were popular. One interesting difference across courses was the extent to which the personality of the instructor was present. Courses developed by single individuals tended to be quite distinctive whereas those created by teams using authoring systems were often fairly impersonal in nature. (p. 3)

Student assessment was reported to be present in a variety of ways. Among the most common method reported was to have students respond to assignments, exercises or exams via e-mail. Kearsley (1998) further elaborates:

> Many courses used online forms for quizzes or tests, which were automatically scored when completed, with immediate results displayed to the student. Most courses had some type of weekly assignments and major projects.

> There was a lot of emphasis on group work in completing assignments and extensive use of peer evaluation schemes. The latter could be as simple as having students comment on each other's responses in a forum to a complex rating system. A number of courses required students to keep online journals or create portfolios for evaluation of their progress. (p. 3-4)

For the purposes of this study, a preliminary analysis of approximately 300 Syracuse University Web sites was conducted during the fall 1997 and the spring 1997 semesters which generated a very basic typology of course Web sites. It is important to note that not all course Web sites available at Syracuse University were included in the analysis. Only those that were residing on the faculty server were examined (http://syllabus.syr.edu) because they were the study's sampling frame (see section 3.4.2.2 for sampling procedures). The analysis revealed that those class Web sites were typically used to supplement class lectures with pointers to references and significant sites and/or as a communication tool between faculty and students. In some cases, use of a class Web site is a requirement, while in other cases it is optional. In terms of purpose and use, these Web sites have a wide range. Some Web sites may serve as instructional support resources for already existing traditional class sessions with functions similar to the typology described by Kearsley (1998). Other Web sites may serve more as bulletin boards or organizers to display and monitor various administrative aspects of the courses such as the course syllabi, class schedules, and housekeeping announcements. In this study, an instrument was developed to classify course Web sites according to their instructional quality. A rating scale was used to describe the functions and characteristics of each Web site (see section 3.5.1).

2.5 Highlights of WBI Research

Reviews of decades of research on computer applications in education have reported that: computer-based learning approaches have improved student achievement, saved students and teachers time, and improved students' attitude toward school and particular subjects (Thompson, Simonson, & Hargrave, 1996). The most prevalent studies of media use in education have been media comparison studies (Thompson, et. al., 1996). In their review of the research, Thompson et. al. (1996) identified several shortcomings of media comparison studies between two media or one media and traditional instruction. One major shortcoming was the tendency to focus on media as the independent variable and learning achievement as the dependent variable where the outcome would be to prove that a particular medium had greater effect on learning. Unfortunately, much of this type of research has been criticized because of design problems (Thompson, et. al., 1996) where instructional strategies, learner characteristics, and instructional content were confounding uncontrolled variables.

Of importance to this study is Salmon and Clark's (1977) invalidation of the "media affects learning" argument that had been the driving cause of sixty years of media research. The 80s and early 90s have witnessed a major debate in the field on media research. This debate concluded that past decades have confounded media and method and that there is no benefit in studying media comparison studies that focus on differences in achievement (Clark, 1983, 1985, 1994a, 1994b; Kozma, 1991, 1994a, 1994b). A second major shortcoming of these studies is the focus on the significant versus non-significant differences on achievement between the groups (Clark & Surgrue, 1988, as cited in Thompson, et. al., 1996). The most outstanding result was that different media did not

significantly differ for achievement between groups (Clark & Surgue, 1988). In summary, a discussion of relevant literature for this chapter excludes all media comparison studies and focuses on (a) design and development literature on Web-based instruction and (b) empirical studies on student- perceptions of Web-based instructional environments. This review summarizes some current trends in media research specific to WWW technology.

2.5.1 Design and Development Literature on WBI

A review of current educational technology literature specific in scope to Web-based instruction resulted in a synthesis of several perspectives, recommendations, and some empirically-based findings for optimal instructional use of WWW technology. The overall perspective favors embracing the new technology, describing the WWW as a highly sophisticated, versatile communication channel for learning and teaching through its integrated multi-media features (Crossman, 1997; Duchastel, 1997; Ehrmann, 1997; Ritchie & Hoffman, 1996; Khan, 1997; Romiszowski, 1997; Starr, 1997). According to Reeves and Reeves (1997) many in this group predict that the WWW will revolutionize instruction and dramatically improve the effectiveness of education and training. There are also those who advocate course re-design for university instruction and pedagogical re-engineering using Web-based course support functionalities (Collis, 1998). Others highlight the promise of the WWW as a distributed learning environment (Dede, 1995; Oblinger & Maruyama, 1996; Saltzberg & Polyson, 1997), while there are some who are perhaps cautious if not skeptical (Descy, 1997; Reeves and Reeves, 1997).

A closer examination reveals researchers' positions that are generally in favor of the technology combined with overall high expectations for the WWW to fulfill its acclaimed promises. The journal of *Educational Technology* (Hackbarth, 1997) featured a special

issue on Web-based learning. The overall tone of the contributing authors was quite positive and optimistic with regard to the rationale for using this technology. Several articles focused on ways to optimize use of the WWW for teaching and learning. Starr (1997), for example, observed that standard instructional design principles apply to the design of Web-based learning programs, but that the unique features of the WWW afford both opportunities and challenges. Quinlan (1997) employed a systematic design approach to utilization of the medium but also cautioned about its disorganized nature and its highly distracting propensities. El-Tigi and Branch (1997) focused on utilization of specific capabilities and attributes of the medium that may serve to heighten learners' interaction, control, and feedback as part of exercising their cognitive learning strategies.

However, in spite of the above-mentioned efforts, this issue was critiqued for "being devoted entirely to technical issues (e.g. Starr, 1997) and teachers' perspectives (e.g., Berge, 1997)" (Hara & Kling, 2000, p.6) and perhaps not equally attending to student-centered research. Added to that, this issue did not provide any empirical findings on WBI. Further analysis of articles in this issue also revealed that the overall focus was on constructing design guidelines for developing Web-based instruction. Many of the authors proposed several strategies for optimizing use of the WWW including some prescriptive applications of their propositions. The shortcomings of the articles are in the lack of reporting actual empirical research findings to support their recommendations and claims. Nonetheless, it is important to take into consideration that this issue was published in 1997, at a time when there was a wide gap in educational technology literature on designing Web-based instruction. Currently, there is a proliferation of design guidelines and recommendations as can be seen in the works of Bonk and Cummings (1998); Collis

(1998); Khan (in press) Langenbach and Freimut (1997) but there is still a shortage in empirical findings to support the emerging theoretical positions.

During the same year of 1997, a book edited by Badrul Khan was published by Educational Technology Publications. This is the first book in the educational technology field to be published on Web-based instruction and is one of the most widely cited references on WBI. The book includes various reports on the definitions, design, development, evaluation, and delivery of Web-based instruction. In sum, a closer examination of the above leads one to conclude that educational technologists have not yet provided higher education with tried and tested applied solutions. Most of the works cited above are not grounded in empirical-research. Hara and Kling (2000) explained this phenomenon as due to the "WWW being relatively young and is still in a testing stage, not an evaluation stage" (p.4).

Indeed, the above observations and conclusions are not surprising as Merrill et al. (1996) observed "many persons associated with educational technology today are engaged in a flight from science" (p. 2) and where the structure of educational technology is becoming more relativistic that scientific. Specifically, several scholars from various disciplines criticized educational technology research pertaining to Web-based instruction for the lack of empirical research. Reeves and Reeves (1997), for example, pointed out that there exists little research evidence that supports claims for the effectiveness of Web-based instruction. On a larger scale, Owston (1997), observed that, while there is rapid growth of WWW use in traditional higher education classes, there is little research on its value and its impact in actually facilitating student learning (Owston, 1997). Some were even concerned about identifying empirical evidence to support recommendations on how the mainstream

educator can benefit from the innovative technology (Butler, 1997). Windschitl (1998) noted that research on the use of the WWW lacks disciplined scholarly articles where most of the published work is either anecdotal descriptions of technology implementation in classrooms or tends to be intuitive analysis of what works and what doesn't work with students (p.1). McClure & Lopata (1996) summed up the state of affairs in higher education as such:

> Despite the fact that many institutions of higher education have built significant networks and have connected to the Internet as part of the evolving national Information Infrastructure (NII), there is little knowledge of how such connectivity has affected the academic institution, in particular how has access to use of these resources affected teaching and learning and other aspects of academic life (p. 1).

In spite of the above observations, empirical research related to integration of WWW technology into instruction is gaining some ground. Since 1996, several studies were published with the purpose of providing empirical research on the effectiveness of Web-based instruction. These studies are most relevant to this study because they are evaluative in purpose and are student-perception studies. The following section highlights some examples conducted in the past five years.

2.5.2 Empirical Studies on Student-Perceptions of WBI Environments

Several studies focusing on student-centered empirical research were reviewed (Andersen & Joerg, 1996; Bonk & Cummings, 1998; Collis, 1998; Hara & Kling, 2000; Hudson, Greer, Buhler, and Paugh, 1998; Jiang, 1998; Reinhart, 1999; Sarapuu & Adojaan, 1998; Schlough & Bhuripanyo, 1998; Van Rennes & Collis, 1998). The participants in

these studies were primarily adults, some were campus students, while others were distance learners. The participants were undergraduate students (Bonk & Cummings, 1998; Reinhart, 1999); graduate students (Collis, 1998; Hara & Kling, 2000); high school teachers from Estonia (Sarapuu & Adojaan, 1998); and adult distance learners (Hudson, Greer, Buhler, & Paugh, 1998; Jiang, 1998). The context in which these studies were conducted varied ranging from distance education courses for part-time adults (Hara & Kling, 2000; Hudson, et al., 1998; Jiang, 1998) to campus-based courses using the WWW as support (Andersen & Joerg, 1996) or Web-based courses offered to campus-based students (Bonk & Cummings, 1998).

2.5.2.1 Research Questions

These studies are among the few that investigated fundamental research questions related to WBI posited in the literature. The questions varied in focus and domain of inquiry such as those concerning rate of use and adoption posited by Anderson and Joerg (1996) were: is the WWW perceived by students and instructors as a valuable aid to the teaching/learning process? and what are the barriers (as perceived by both teachers and students) to adoption and use of this technology? (1996). Others were concerned with affective issues of students' learning experiences. For example, Hara & Kling (2000) posited affective questions such as: how do students' frustrations in Web-based distance education courses inhibit their educational opportunities? and how do students deal with those frustration? Hudson et. al. (1998) were concerned with students' perceptions of factors related to administrative support, technology use, and organization of a Web-based distance course. Similarly, Bonk and Cummings (1998) were concerned with students' success and struggles of Web-based learning. Other types of questions were more validation of the course Web sites, from a student perspective, in terms of content (Sarapuu

& Adojaan, 1998), user interface design (van Rennes & Collis, 1998), and course design and development (Bonk & Cummings, 1998). Other studies were more specific to learning by examining factors influencing students' perceptions of online learning (Jiang, 1998), and student motivation, self-efficacy and task difficulty in Web-based instruction (Reinhart, 1999).

2.5.2.2 Methodology

These studies varied in their data collection methods. Some employed a case-based study method (Hara & Kling, 2000). The majority employed online or print-based survey method (Andersen & Joerg, 1996; van Rennes & Collis, 1998; Reinhart, 1999; Sarapuu & Adojaan, 1998). Others employed observations, document reviews, content analysis of online correspondence, and interviews (Bonk & Cummings 1998; Hara & Kling, 2000; Jiang, 1998).

2.5.2.3 Relevant Findings

Findings of the studies were similar in that they were student-centered but different in the domain of inquiry pertaining to students' learning experiences as demonstrated in each study research questions stated above. What is also common to all these studies is that they engaged in formative evaluation methods used in instructional design to pilot and field test instructional interventions (Dick & Carey, 1996) specific to a Web-based context. Findings from these studies can be classified into two categories: (a) student-perception of learning studies and (b) student-evaluation of Web site development studies. In some cases, the study was a mix of both. The following section summarizes the pertinent findings of each study.

a) Student-Perception of Learning Studies

Anderson and Joerg (1996) found that both students and instructors perceived the WWW as a valued education enhancement. Significant barriers to adoption including access restrictions, questions related to relative advantages of the technology, and problems in the creation and organization of large quantities of WWW pages.. Students reported that the WWW changed the dynamics of access to class materials at any time from different locations. They also reported several enhancements in the speed with which class materials were revised by instructors; in their capacity to review materials, and in the reduction of paper consumption. Students appreciated the hypertext linkages embedded in the course material. Negative comments were related to access problems due to restrictions in hardware and telephone lines, and the inability to personally annotate class notes and materials. Students also expressed concerns over the time spent on external Web sites. They pointed out that it was "time-wasting".

Bonk and Cummings (1998) found that students appreciated the openness of Web-based conferencing as well as the collaborative spirit of peers in providing feedback and queries. Students reported that they felt less inhibited when using conferencing tools which enabled them to engage in controversial discussions. Students appreciated having some personal choice and alternatives within class assignments. The researchers also found that electronic syllabi must be clearer on the Web than in traditional classrooms to avoid student confusion and anger in a Web-based environment where face-to-face immediate clarifications were missing.

Hara and Kling (2000) found students' frustrations with a Web-based distance education course originated from two sources: technological problems and pedagogical issues. Technological problems included students' difficulty in obtaining technical support

especially for students with inadequate computer skills. Pedagogically frustrating issues included minimal and not timely feedback from the instructor and ambiguous instructions on the Web or through e-mail. The impact of these frustrating experiences resulted in some students dropping out of the course, negative attitude toward Web-based distance education, and "giving up" on the formal course content.

Hudson et. al. (1998) examined two relevant aspects: support needed by students and essential organization of the course. They found that in terms of support for Web-based training courses, trainees appreciated support from each other and from family members as they perceived Web courses to be time-consuming. Novice students appreciated the support from peers especially in overcoming technological hurdles such as sending an assignment, receiving instructions on sending e-mail attachments, posting comments on the bulletin board, etc. In terms of course organization, findings included posting tips to follow when using various course functions; minimizing changes during the course; and posting due dates well ahead of time as not every student is online daily or even every other day.

Jiang (1998) found that socio-collaborative course environments are more conducive to perceived learning. Second, grades for discussion and requirements for discussion were significantly and positively related to students' perceived learning. Third, a course with a balance between BIG (beyond information given) and WIG (without the information given) is more conducive to perceived learning. Results showed that a certain amount of instructional support (content presentation and responses) is needed. In addition, a relationship between structure and nature of instructors' questions and patterns of students' responses was found. Courses with high perceptions of student learning were

elaborately designed, focused on students' own experiences and sought multiple perspectives. Likewise students' responses in these courses were drawn from personal experiences, familiar examples, and went beyond the understanding level.

Reinhart (1999) found a positive relationship between students' self-efficacy for WBI and motivation to learn from WBI. Second, students' motivation to learn from WBI was positively related to achievement with WBI. Third, students' control of learning may not be an important issue for certain types of WBI activities such as WebQuests because students' motivation and achievement levels did not appear to be significantly related to their 'control of learning beliefs'.

b) Student-Evaluation of Web site Development Studies

Sarapuu and Adojaan (1998) developed an evaluation scale of educational Web sites and reported results based on their participants' use of the evaluation scale. The scale focused on technical, pedagogical, and subject-related criteria of evaluation. Unfortunately the study reported only comparative results on evaluations of two courses on each of the above stated dimensions. While the instrument does show consistent variation between the two sites examined, no information is provided on the validity of the instrument or on any theoretical basis for the development of the items in the instrument.

Schlough and Bhuripanyo (1998) found that a Web-based course using Asymetrix Toolbook II Instructor software was a viable way to deliver teacher education instruction to distant learners in remote locations. Students' evaluation of the course indicated that the strengths of Web-based delivery was in the convenience in terms of time and space; the promotion of individual self-paced learning; the open display of course products; the clarity and importance of online content in relation to course objectives; and the increased sense of connection with the course instructor. Weaknesses in the Web-based delivery system were

in the requirement for self-discipline; that it was not appropriate for all learning styles; and that it had the potential for being impersonal as not all students worked together.

In their study of student evaluations of a user-based interface design for Web courses, van Rennes and Collis (1998) found that students preferred a "sequential time" as a navigational approach to course Web sites as opposed to a metaphor of "Centers" that was used by the instructors. A sequential time is a way of organizing the course Web sites by what is needed for a given week. Whereas the "Center" metaphor means that the course is organized by virtual locations of information such as the "Production Center", "the Study Center", and the "Search Center".

In summary, these studies are pioneering efforts in providing empirical evidence for the effectiveness (or lack of) WBI in both distance learning and campus-based contexts. They shared a common goal in that they sought to gain a better understanding of the design and utilization of Web-based instruction. Replication of these findings is necessary. This study contributes to this growing body of empirical research on WBI. This study is similar to the above studies in that it investigated factors that affect students' learning experiences from a student perspective and it also engaged in instructional course Web site evaluation from an instructional designer's perspective and students' perspectives. The study makes additional contributions to the above literature in that it covers students' perceptions of the usefulness of theory-based instructional functions of the WWW. Relevant findings from the above studies in association with this study are further presented and discussed in chapter six.

In conclusion, research toward the identification of optimal functions provided through the capabilities of WWW that can be used to support instruction thus increasing its

utility and value to students and faculty is a necessary next step. These functions need to be identified, tested, and analyzed in an empirical setting. This means a study of these specific instructional functions that can be supported by Web technology. Furthermore, a review of the literature has shown that there has been no cross-sectional studies conducted campus-wide and across disciplines. This study contributes to closing this gap in the literature. Support for this endeavor was drawn from the principles of instructional design. The following section presents a summary of what is considered effective instruction and how theory becomes practice in a Web-based environment.

2.6 Effective Instruction - Theory and Practice

Instruction can be defined as a "purposeful interaction to increase a learner's knowledge or skills in a specific, pre-determined fashion" (Ritchie & Hoffman, 1996). Effective instruction is "instruction that enables students to acquire specified skills, knowledge, and attitudes. Effective instruction is also instruction that students enjoy." (Dick & Reiser, 1989 p. 2). According to Dick and Reiser, effective instruction can be measured by how students perform on a particular learning task and how they feel as a result of the instruction they receive (1989). Student learning is promoted through instructional design procedures and tools that are based on "correct" instructional strategies (Merrill, Drake, Lacy, Pratt, & the ID_2 Research Group, 1996). Instructional design facilitates effective learning through practical applications combining learning theory with instructional design models and principles (Gredler, 1992). Moreover, "there is a body of knowledge and skill that has been developed and archived by generations of scholars, scientists, technologists, artists, and others. The purpose of instructional design is to

develop the experiences and environments that *facilitate* [Italics added] the students' acquisition of this knowledge and skill" (Merrill, et. al. 1996, p. 2).

The significance of utilizing the Web for instructional purposes lies in its power to deliver large amounts of information in an open system through the use of hyperlinking. However, there seems to be an implicit belief that "speedy access to lots of information equals learning" (Sherritt & Basom, 1997, p.8). It therefore becomes necessary to make the distinction between information and instruction. One distinction was aptly stated by Duchastel (1997) as follows:

> ...it [That information is central to learning] does not imply that knowledge is but an accumulation of information; rather it means that it is information that generally triggers transformations of knowledge that bring growth and development of intellectual skill. These do not occur in a vacuum but rather build on concrete information that either questions current thinking or provides supportive feedback to help elaborate a growing viewpoint. How that information is obtained is of little consequence; what is important is that it is available at the time of need; and in principle, greater accessibility leads to actual availability when needed (p.6).

Consequently, while the WWW promotes access to a wide-reaching range of resources, it does not, by design, facilitate learning (Hill & Hannafin, 1997) or foster and support it (Khan, 1997). Neither does publishing a WWW page with links to other pages or other sources, constitute instruction (Ritchie & Hoffman, 1996). Bannan-Ritland, Harvey, and Milheim (1998) described the current situation as follows:

> The mere use of the World Wide Web in a specific course does not automatically imply effective instructional activities or quality instruction for the

> intended learners since many courses are simply a juxtaposition of a variety of instructional and non-instructional Web-based elements, with some courses utilizing the Web in a very limited manner and others using Web-based activities to provide a totally online instructional experience. In fact, while many instructional elements that exist in stand-alone Web pages or as parts of overall Web sites may serve valuable functions in supporting course interaction and/or providing administrative guidance, they may not, in and of themselves, significantly contribute to meaningful learning. (p. 77)

Consequently, when designing an instructional Web site, certain principles of instructional design ought to be taken into consideration as a means of providing quality instruction and the support and fostering of meaningful learning that are essential components in the definition adopted for WBI. So how is this made possible? Many highly reputed instructional designers would agree that there are certain functions that ought to be present in an instructional sequence to meet the above criteria. These functions would motivate students by explaining what is to be learned; help students to recall previous knowledge; present instructional material in attractive and meaningful diverse ways; elicit performance; provide guidance and feedback; assess comprehension, application, synthesis; and provide enrichment and remediation to facilitate transfer (Bloom et al., 1964; Dick & Reiser, 1996; Dick & Carey, 1996; Gagné, 1975; Gagné, Briggs, & Wager, 1992; Grau & Bartasis, 1998; Merrill, 1980, Merrill et. al., 1996). Based on the above rationale, incorporating the above functions into instructional interventions designed to be delivered on the Web is one means of determining the instructional quality of a given Web site. This could be achieved by assessing the extent to which these events exist in the

design of the site. The work of Robert Gagné (1965, 1975) in designing effective instruction, also known *as the nine events of instruction* provides a theoretical framework that is widely known and used in the instructional design that specifically targets the micro level of lesson design. The following section further defines and explains the nine events of instruction and provides examples of application in research studies.

2.6.1 Gagné' s Nine Events of Instruction

Instructional events are a set of communications that aid the learner in the learning process. Furthermore, good instruction works hand in hand with the internal learning process by providing the necessary stimulant or reinforcement desired (Gagné, Briggs, and Wager, 1992). Effective instruction necessitates that the external conditions for learning support the internal conditions for learning. The nine events represent a structured, systematic way of breaking down the learning process into stages of learning (see Table 2). At each stage, there is a specific event that ought to occur to induce learning. Gagné, Wager, and Rojas (1981) provided guidelines to use of the nine events of instruction as a framework for planning and authoring computer-assisted instruction lessons. The events of instruction represent a sequence of steps that support and "stimulate the learner so as to make learning readily occur" (p.18), the rationale being there are several steps to learning that could be accompanied by several stages to the series of displays that support and enhance learning. Gagné et al. (1981) stated that "in any complete act of learning, there must be nine events of instruction" (p.18) that complement each act of learning.

Table 2 outlines the nine events of instruction, provides a rationale and purpose for each event, and illustrates the connection between these events and the related learning principle. For example, *gaining attention* is an instructional event that serves to stimulate

reception of information. Its purpose is to direct learner's activity toward an objective through motivational strategies. These strategies make reception of information more possible due to increased perception of the relevancy and meaningfulness of the information to learner's needs. Similarly, *enhancing retention and learning transfer* is another instructional event that serves to facilitate transfer of newly acquired knowledge to new situations. The purpose of this event therefore is to enable the learner to retain information for useful purposes and future recall. It also provides opportunities for the creation of rich meaningful associations of isolated facts and generalizations of new information through its application to a range of practical situations.

Furthermore, it is important to point out that not all nine events need always be present in one lesson. Yet, "the planning of Computer Assisted Instruction (CAI) needs to make potential provisions for the display of frames containing print and diagrams to reflect all of the nine events" (Gagné et al., p.19). "The sequential order of these events is roughly from one to nine, although reversals within the sequence may sometimes be desirable but restricted to events that basically provide 'stimuli to be used in learning' such as events that stimulate recall, present new material, and guide learning. Furthermore, the decision to exclude an event must be deliberate (Gagné et al. p.19).

Table 2

A Matrix Showing the Relationship Between Gagné's Nine Events of Instruction, Learning Principles, Rationale, and Related Studies in Computer Assisted Instruction (CAI)

Gagné's (1992) Events of Instruction (p. 201)	Theoretical Underpinnings	Rationale	Related Studies in CAI
1. Gaining attention	Reception of stimuli by receptors	To direct learner's activity toward a given objective To motivate the learner and thus make learning more meaningful and relevant to learner needs	Hannafin and Peck (1988)
2. Informing learner of lesson objective	Registration of information by sensory registers	To inform the learner of objectives To inform learner of WHAT they are about to learn To activate a schema for classification and organization of new material into long-term memory To define expectations	Evertson, Anderson, and Brophy (1978) Emmer, Evertson and Anderson (1980) Emmer, Sanford, Evertson, Clements, and Martin (1981) Kozma (1982) Stanford Center for Research Development (1975)

Table 2 Continues

Table 2 (Continued)

A Matrix Showing the Relationship Between Gagné's Nine Events of Instruction, Learning Principles, Rationale, and Related Studies in Computer Assisted Instruction (CAI)

Gagné's (1992) Events of Instruction (p. 201)	Theoretical Underpinnings	Rationale	Related Studies in CAI
3. Stimulating recall of prior learning	Selective perception for storage in short-term memory	To promote transfer from one part to the next To activate the learner's schema which enables him/her to assimilate new information and place it in long term memory To provide a mind set for the learner to develop his/her own strategies for learning and to take the initiative in determining which of the recalled learning is applicable for the need of the moment. To build upon prior knowledge so as to avoid creating gaps in the learning process	Emmer, Sanford, Clements, and Martin (1982) Fortune (1967) Kozma (1982) Standford Center for Research and Development (1975)

Table 2 Continues

Table 2 (Continued)

A Matrix Showing the Relationship Between Gagné's Nine Events of Instruction, Learning Principles, Rationale, and Related Studies in Computer Assisted Instruction (CAI)

Gagné's (1992) Events of Instruction (p. 201)	Theoretical Underpinnings	Rationale	Related Studies in CAI
4. Presenting stimuli with distinctive features	Rehearsal to maintain information in the short term memory	• To allow for introduction, explanation, and clarification of material to be learned and applied	Hannafin and Peck (1988)
5. Providing learning guidance	Semantic encoding for storage in long-term memory	• To provide the learner the opportunity to master the learning objective in a friendly environment where the learner can test out his/her comprehension of the material • To scaffold the learning process by bridging the gaps	Armento (1976) Emmer, Sanford, Evertson, Clements, and Martin (1981) Evans and Guyman (1978) Gage, Belgrade, Dell, Hiller, Rosenshine, and Unruch (1968)

Table 2 Continues

Table 2 (Continued)
A Matrix Showing the Relationship Between Gagné's Nine Events of Instruction, Learning Principles, Rationale, and Related Studies in Computer Assisted Instruction (CAI)

Gagné' s (1992) Events of Instruction (p. 201)	Theoretical Underpinnings	Rationale	Related Studies in CAI
6. Eliciting performance	1. Retrieval from long-term memory to working memory	• To enable the learner to demonstrate what he or she has learned after interacting with the material. • To determine whether the learner is ready to move on to the next enabling objective. • To determine the extent to which the learner has mastered each essential prerequisite toward achieving the terminal objective. • To monitor learner progress	Emmer, Sanford, Evertson, Clements, and Martin (1981) Emmer, Sanford, Clements, and Martin (1982) Fisher (1980) Kozma (1982)
7. Providing informative feedback	Response generation to effectors	• To inform learner whether his/her performance was successful. • To indicate missing or incomplete tasks/statements/actions. • To indicate/suggest/ • identify/negotiate ways for improvement	Gersten, Carmine, and Williams (1982) Good and Grouws (1979) Evertson, Anderson, and Brophy (1978) Hughes, 1973) Stallings (1978) Wager and Mory (1992)

Table 2 Continues

Table 2 (Continued)

A Matrix Showing the Relationship Between Gagné's Nine Events of Instruction, Learning Principles, Rationale, and Related Studies in Computer Assisted Instruction (CAI)

Gagné's (1992) Events of Instruction (p. 201)	Theoretical Underpinnings	Rationale	Related Studies in CAI
8. Assessing performance	Performance in the learner's Environment	To assess successful accomplishment of objective after completion of learning and instruction for the entire objective. To determine the validity, reliability and accuracy of measuring learner success or mastery of objective	Lillie, Hannum, and Stuck (1980) Medina (1990) Tenenberg (1970)
9. Enhancing retention and learning Transfer	Transfer to new situations	To retain information for useful purposes and future recall To allow for creating rich meaningful associations of isolated facts To promote transfer of such knowledge to real life situations To enable learner to generalize this new information by applying it to a range of practical situations	Gredler (1992) Medina (1990)

(adapted and extended from Gagné', Wager, & Rojas , 1981)

Since there are no research studies to date that report findings from having used the nine events of instruction to guide the design of instructional Web sites, evidence for the effectiveness of the nine events of instruction was found in research studies in the domain of Computer Assisted Instruction (CAI). Wang and Sleeman (1994) in their review of CAI research identified several studies that demonstrated the usefulness and effectiveness of the nine events when applied to CAI context. Research studies reviewed and cited by Wang and Sleeman (1994), in addition to other studies, are included in Table 2. However, it is important to emphasize that Gagné's work is considered the legacy of the field of instructional design: theory and practice (Richey, 1996; Richey, 2000; Ritchie & Hoffman, 1996; Smith & Ragan, 1996). Gagné's (1965, 1975) principles are generally considered to be exemplary of traditional instructional design principles and the most comprehensive and fundamental constituents of effective instructional design (Fields, 1996; Richey, 1996; Richey, 2000, Smith and Tillman, 1996).

2.6.2 Application of Gagné's Nine Events of Instruction to a Web-based Context

While Gagné's work was primarily carried out in the 70s and 80s before the creation of the Internet, a review of the literature pertaining to current instructional design theories for WBI pointed to several advocates of the use of Gagné's nine events of instruction to design Web-based courses. Ritchie and Hoffman (1996) provided suggestions on how each of the nine events could be applied to Web design. Grau and Bartasis (1998) advocated the use of the nine events of instruction to evaluate hypermedia programs to determine the extent to which they are instructional. The medium of instruction primarily acts as a vehicle but can be manipulated in ways that optimize delivery of instruction (Clark, 1983, 1994a; Kozma, 1994a). If there is no apparent instructional design blue-print, this information could become

overwhelmingly unstructured thereby impeding the learning process (El-Tigi & Branch, 1997). Therefore, it becomes necessary to design instructional material utilizing instructional design principles to present instruction on the Web in ways that facilitate learning and optimize the multi-dimensionality of the Web and its non-linear capabilities. In other words to provide the necessary support and fostering of a meaningful learning environment essential to Web-based instruction as previously defined by Khan (1997). One way to do that would be to apply Gagné's nine events of instruction to the design of Web-based courses. A major contribution of this study is to apply Gagné's nine events of instruction to the evaluation of course Web sites from students' perspectives on the quality and usefulness of the course Web sites as an instructional resource.

Some limitations to be noted are that, while the events of instruction would most probably generate a more effectively designed instructional program, there are many other unexplored opportunities and constraints in practical use of the medium that may not necessarily be addressed by the nine events. The nine events are procedural steps for the design of instructional interventions and do not provide rich details on how to design meaningful learning environments where students constructively create knowledge that are also specific to a Web-based environment. Such a limitation of the model is not of particular relevance to this study however. Basically, the model provides basic ingredients to successful teaching and learning practices as external stimuli to support and foster internal cognitive processes of learning (see Table 2 for a match between learning theory and nine events).

2.6.3 The WWW as Lever to Good Teaching and Learning Practices

A second part of the conceptual framework provided in chapter one (see Figure A) focuses on teaching and learning practices in a higher education context. It is adopted to ground the study in practical applications. The higher education efforts to integrate technology in teaching and learning have led to the rise of a project like the Annenberg/CPB Flashlight Planning Project which began in 1994 to help educators answer questions about technology and educational improvement (Ehrmann & Zuniga, 1997). This project is "designed to help institution(s) learn whether technology is helping them improve practices and outcomes over time and, if not, why not" (Ehrmann, 1997a, p. 1)

Members of this project emphasize that educators need to understand how their uses of technologies such as computing, video, and telecommunication are enabling improvement in their educational strategies. Moreover, educators also want to know whether such improved strategies promote desired improvement in what students have learned by the time they complete the program (Ehrmann, 1997a). The major concern is not necessarily measuring learning achievement as was the case in the past with any introduction of new technology, but more of the value-added that new technologies bring to the instructional environment. Stephen Ehrmann, director of the Flashlight Project - The American Association for Higher Education (AAHE) summed up the problem as follows:

> Many people assume that evaluation of the outcomes of technology investments is easy: "Just see whether students are learning more! But the real value-added from technology usually comes when

instructional objectives change, which means tests change, too. It's useless to discover that students scored 80% on one test and 90% (or 80% or 75%) on a different test administered three years ago. On the other hand, if you can discover that:

- the conditions for good learning have improved (as measured by increased implementation of the seven principles); and
- the faculty and the students believe that their use of technology was substantially helpful, then you've learned something important.

Similarly it would be useful to discover that collaborative learning is down and that e-mail has been problematic. Or even that collaborative learning is extensive but e-mail is widely seen as alienating (Ehrmann, 1997a, p. 5).

2.6.4 The Seven Principles of Good Teaching and Learning Practices

The principles were created originally in 1987 by Art Chickering and Zelda Gamson with support from Lilly Endowment, the Johnson Foundation and the American Association of Higher Education (AAHE) (Chickering & Ehrmann, 1996). According to the authors they are the result of distilled findings from decades of research on the undergraduate experience. The seven principles of good practice employing technology as a lever are described below:

1. Good practice encourages contacts between students and faculty

Electronic mail, computer conferencing, and the World Wide Web increase opportunities for students and faculty to interact and communicate much more efficiently than before. In addition, the nature of communication becomes more thoughtful, deliberate, convenient and safe. The negative aspects of face-to face confrontation are lessened.

2. *Good practice develops reciprocity and cooperation among students*

Through the use of the above mentioned technologies, both synchronous and asynchronous communication with peers and experts in the field is increased. Student collaboration is encouraged. Through collaboration and better communication, skills such as problem-solving, leadership, and active learning are fostered.

3. Good practice uses active learning techniques

Active learning is an essential component of the learning process. Students learn through discussions, reflective writing, making meaning out of what they are learning by relating it to previous knowledge and skills gained. Technology can be used as a learning tool such as using the Web as a search tool for large databases of information. Through Java-based simulations, students can study simulations in physics where they can manipulate the data source and instantly see resulting changes.

4. *Good practice gives prompt feedback*

The use of e-mail to support person-to person(s) feedback is one way of providing feedback. The multimedia capabilities of the Web allow for an almost seamless integration of video clips, sound, images, and animation thereby allowing for multiple modes of communication through feedback and assessments.

5. Good practice emphasizes time on task

Time on task is a requirement for effective learning. Teaching strategies that make use of the Internet can be time-saving in many ways. By allowing students to learn at home or at work, they can save time on commuting to and from campus, finding parking places, or going to the library where they have to physically run around to retrieve resources, thus increasing productivity.

Using the Internet to communicate is also time efficient due to its synchronous and asynchronous nature.

6. *Good practice communicates high expectations*

Expecting students to perform well becomes a self-fulfilling prophecy (Chickering & Ehrmann, 1996). New technologies can communicate high expectations by providing access to all sorts of information that can be easily distributed between people worldwide. Samples of work can be shared as exemplary work or even for peer reviewing. Students are exposed to a multitude of perspectives, data sources, and real-life problems that provide them with powerful learning challenges that were not so readily available prior to the Internet.

7. Good practice respects diverse talents and ways of learning

Diversity in learning styles and perspectives enriches the mind. Technological resources can accommodate different learning styles and teaching methods. The multi-dimensionality and multi-modality of the World Wide Web accommodate and foster this diversity.

The Flashlight Current Student Inventory (CSI) is a toolkit developed by the Flashlight Project for creating periodic studies of students' perspectives of changes in teaching and learning practices using the seven principles of good teaching and learning practice in undergraduate education (Chickering & Gamson, 1987; Chickering & Ehrmann, 1996) as a theoretical underpinning. Five institutions helped design and test Flashlight: Indiana University Purdue University Indianapolis (IUPUI), Washington State University (WSU), Education Network of Maine, Maricopa Community College, and the Rochester Institute of Technology (Ehrmann & Zuniga, 1997). Several case studies have been reported using CSI to create student surveys to explore three different uses of technology in three different contexts at WSU (Brown, 1998) and at IUPUI

(Harrington, 1998). These studies, however were primarily pilot studies and the finding are not directly related to the focus of this study. [3]

The author has sought the support of the Flashlight Project CSI in the design of the study survey instrument. Specifically, it was used to create a section in the questionnaire that indicates how much time students spent in a typical week using their course Web sites and also to create the open-ended student satisfaction questionnaire items. These items are identified in chapters three and four.

2.7 Chapter Summary

This chapter placed the present study in the larger context of educational research pertaining to use of the Internet, with a particular focus on the WWW and theories on instructional effectiveness. The chapter introduced the phenomenon of study, students' perceptions of the WWW, and provided empirical evidence for the WWW's growing presence in higher education. The history and characteristics of WWW technology were discussed. Web-based instruction was defined and a typology described. WBI highlights of empirical research were discussed. Two sets of pedagogical principles were presented and discussed in the context of designing WBI and as the basis for explaining the study outcomes. Details of the study context, research methodology, instrument development, and data collection procedures and analysis are described in the next chapter.

[3] The author has contacted Dr. Stephen Ehrmann on several occasions to identify any other studies that used the 7 principles but was unsuccessful in finding other than what is reported.

CHAPTER THREE

Methodology

3.1 Introduction

This chapter presents and delineates the research methodology employed in the study. The chapter is divided into the following sections: the research questions, the context of the study, and the methodological approach which encompasses: choice of methods, sampling procedures, sample representativeness, and approach to increasing response rate. The remaining sections of the chapter briefly introduce the instruments and conclude with a summary of data coding, cleaning, and analysis procedures.

3.2 Research Questions

Included is a brief explanation of what each question serves to address in relation to the purposes of the study.

1. How did students allocate their time using their course Web sites?
2. What was the quality of the course Web sites according to students?
3. How useful did students perceive their course Web sites?
4. What demographics and characteristics influenced students' use and perceptions of quality and usefulness of course Web sites?
5. What were some student reported barriers to and facilitators of use of the course Web sites and overall impact of the WWW on students' learning experiences?

Question #1 examines students' use of their course Web sites. It also provides data on specific time spent on each function, in a typical week, that the course Web site makes

available. The focus is on identifying users and non-users of various Web site functions. The question also serves to provide information on the ranking of each function in terms of time spent.

Question #2 examines the quality of course Web sites according to students. The focus is on describing specific Web site functions that were most and least appreciated by students.

Question #3 examines students' perceptions of the usefulness of various functions. The focus is on describing specific Web site functions that students found most and least useful.

Question #4 focuses on gaining insights into some contextually related demographics and characteristics that may influence students' perceptions on the various study dimensions. This question is answered by examining statistical relationships particularly with demographics and characteristics of the respondents. These demographic variables such as age, sex, academic class, and GPA have traditionally been explored in the social sciences and in educational media research (Thompson, Simpson, & Hargrave, 1996). However, there are other variables that have not been explored prior to this study in a context where the WWW is used as an instructional resource to campus-based teaching and learning. Variables of particular interest to the author are: student residential proximity to campus, regular access to computers, modem speed, type of connection, reasons for taking the course, and nationality of students. These variables were selected based on interviews conducted by the author with ten students enrolled in the spring of 1997. The pilot course was one of the classes that made the final screening for course Web sites. Another reason is the author's familiarity with the context of the study.

Examination of relationships between demographics and student characteristics and the various dimensions of the study: *Time Spent, Quality, and Usefulness* provides empirical data for audience analysis. In a survey and analysis of instructional design and development models, Gustafson and Powell (1991) and Gustafson and Branch (1996) emphasized audience analysis as a necessary stage in instructional design systems. Similarly, Dick and Carey (1996) and Romiszowski (1984) discussed at great length the importance of audience analysis in designing instructional interventions which entails familiarization with student knowledge base and skills, access to computers, Internet skills, learning environment, and other more traditional demographics such as age, sex, GPA, and academic class.

Question #5 focuses on gaining insights into some contextual factors related to the students' learning environment that might explain and guide interpretation of findings. This question is answered by identifying emergent themes from narrative data pertaining to barriers to and facilitators of the use of course Web sites from students' narratives on the open-ended sections of the questionnaire. Students' perceptions of the impact of the WWW on their learning experiences are also elicited. This question also taps into qualitative data that the pre-ordinately designed questions may have missed.

3.3 The Context of the Study

Syracuse University (SU) is a Research II private university under the Carnegie Classification (Directory of Higher Education, 2000). Located in central New York State, it was founded in 1870 as an independent coeducational institution (About SU, 2000). Syracuse University promotes itself as working toward being a more student-centered research university that makes student learning its highest priority.

Demographically, at the time this study was conducted during the fall of 1998, 50 states, 4 territories, and several countries (unspecified), were represented. A total of 12,130 undergraduates, 6,163 graduate and law students, and 1,681 foreign residents comprised the student body on campus for fall 1998 (Institutional Facts and Figures, 2000). Syracuse University's academic mission is to promote learning through research, scholarship, creative accomplishment, and service. Its vision is to be the leading student-centered research university.

3.3.1 Access to Computers at Syracuse University

Students may use any of the 700 DOS/Windows and Macintosh personal computers across campus without charge, regardless of their majors. Computers have word processing, Web browsers, graphics, statistical and data analysis, database management, programming, and communications capabilities such as telnet and ftp. Interconnected to the University's high-speed network, these computers provide access to a Unix timesharing network and the Internet (About SU, 2000). It is worth noting that one class from the State University of New York - Environmental School of Forestry (SUNY-ESF) was included in the study because its course Web site resided on the SU faculty server. When the study was conducted, students attending SUNY-ESF had access to most SU facilities including SU computer clusters.

3.3.2 Faculty Support to Use the WWW as an Instructional Resource [4]

At Syracuse University, Web sites specifically designed for teaching and learning purposes are the responsibility of the individual faculty teaching the course. The faculty member either personally develops the Web site or a student is assigned by the course instructor to the development task.

As of the fall 1998, there were over 400 Web sites on the Syracuse University centralized faculty server for Web-based material, some dating back as early as the fall 1995. Some sites continue to be updated and modified for use each time the course is offered, while some others are abandoned for various reasons not relevant to this study.

In terms of physical location and access, many of these sites actually reside on the publicly accessible faculty server housed at the Faculty Academic Computing Support Services (FACSS) computer labs, while many others reside either on departmental servers or on the Syracuse University server for personal home pages and are then linked to the faculty server. There are no explicit university policy that specifies where these Web sites may reside. The faculty Web server is a means of providing additional memory capacity for faculty to store their information and as a service to maintain the server offered by FACSS. However, the actual maintenance of the site is the responsibility of the faculty member himself/herself. The author's own experience in developing and maintaining a course Web site residing on the SU faculty server confirms the above report.

[4] Based on observations conducted on Web sites since the fall 1997 and several personal visits and phone conversations with key personnel in the Faculty Academic Computing Support Services (FACSS) at Syracuse University, the following is a description of the status of course Web sites during the academic year of 1997-1998.

3.3.3 Course Web Sites on the Faculty Server

Since the fall of 1995, many different types of Web sites have been made available to Syracuse University students. They vary in type and purpose ranging from predominantly informational bulletin boards and an electronic version of course syllabi, to sites that engage students in various instructional activities. The latter were classified as closer to what has been defined in chapter two as *instructional* as opposed to *informational* (see section 2.6). Taking the above contextual factors into consideration, the author chose to focus on the faculty server as a sampling frame for course Web sites. The rationale being that this was the only server that housed and linked to the largest number of course Web sites offered by SU and SUNY-ESF.

3.4 Methodological Approach

A theoretical framework frequently cited in the literature on survey design is the *Total Survey Design* (Fowler, 1993; Platek, 1985). This framework guided the design of the study and operationalization of the research questions and data collection procedures. The following section summarizes contextual and procedural factors considered in light of this systemic theoretical framework.

3.4.1 Choice of Methods

It is the purpose of the study to survey a wide range of students from various disciplines to allow for larger variations across groups and subsequent generalizability of common student experiences in using various Web sites. Using a questionnaire to survey a large population was judged to be the most appropriate method.

3.4.2 Sampling Procedures

The purpose of this section is to describe and justify how course Web sites and students were selected to participate in the study.

3.4.2.1 Web Site Sampling

Sampling procedures began by selecting the Central New York (CNY) region for convenience of location and logistics for the author. At the time the survey was conducted, Syracuse University also had the largest pool of supplementary course Web sites located on one server in the region (based on author's observations and several visits to WWW sites used in a similar context in the CNY region). Selection of course Web sites was conducted using the Syracuse University's faculty server as the sampling frame. This server is accessible at http://syllabus.syr.edu. After an initial screening of 174 Web sites for the fall of 1997, a total of 71 course Web sites were included in the sampling frame. Of the 71 course Web sites, 17 Web sites made the first screening by receiving a score of 3.5 [out of 9] or higher on the WIDEC instrument created by the author to screen the various course Web sites according to their instructional design quality. WIDEC consists of 30 items with a maximum score on a Likert scale of 90. This became the WIDEC score which was later converted to a GAGNÉ score by dividing 90 by 10 to make the scale comparable to the nine events. Of the 17 Web sites, 9 Web sites made the final screening: three Web sites with scores ranging from 3.5 - 4.4, 3 sites with scores ranging from 4.5-5.4, and three sites with scores ranging from 5.5-8.0.

3.4.2.2 Student Sampling

Participants for the study were students taking classes that have Web sites posted on a dedicated server on SU campus during the fall of 1998. The sampling

frame for students was comprised of students in the classes that were included in the study. In classes with 25 students or less, each student received a questionnaire. Three of the nine classes belonged to this category (SPP 500, WRT 100, WRT 300). The remaining six classes all had at least 100 students registered. Only 40 questionnaires were distributed to each of these larger classes. Sampling in this case took place by counting every *nth* student (calculated by size of class divided by 40). A total of 920 students were enrolled in the nine classes, 30% of which were included in student sampling pool (285). The number of respondents was 142/285. See section 5.2 in chapter five for a break down by course.

3.4.2.3 Sample Representativeness

Findings from this study may be generalizable to Syracuse University students attending school during the academic year 1998-1999. Table 3.1 is a comparison of demographics with figures reported on the online SU Student Enrollment Report for fall 1998 (Institutional Facts and Figures, 2000). Figures in Table 3 are reported in percentages. Table 3 does not include SUNY-ESF student enrollment for the fall of 1998.

Table 3

Comparative Matrix on Common Variables Between Sample Demographics and Syracuse University Fall 1998 Enrollment Report in Percentages

Common Variables		Study* Sample	Fall 1998 Enrollment
Totals (Full-time and Part-time)			
Undergraduates		94	72
Graduates		6	28
Academic Class			
Freshmen		25	23
Sophomores		15	23
Juniors		29	23
Seniors		24	24
Other		1	6
Graduate**		8	-
Gender			
Female		54	54
Male		46	46
School or College (Undergraduates only)			
School of Architecture		0.8	3.5
College of Arts & Sciences		43.5	29.9
School of Education		4.6	4.4
College of Engineering & Computer Science		4.6	7.9
College of Human Development		0.8	6
School of Information Studies (IST)		0.8	4.3
School of Management		7.6	11
College of Nursing		NA	2.8
Maxwell School of Citizenship and Public Affairs		0.8	NA
School Public Communications		13	11.6
School Social Work		NA	1.6
VPA		2	16.8
SUNY-ESF		14.8	NA
Nationality			
Undergraduate	American	91.7	96.4
	Non-American	8.3	3.6
Graduate	American	100	79.8
	Non-American	0	20.2

* 4 missing responses not included

** Graduates in this study are not representative of SU Graduate population

Note 1: Figures include rounding errors

Note 2: Student Enrollment in International Study Abroad Programs and University College and branches is not included since none of these students were represented in the sample.

Note 3: The study did not examine diversity in terms of ethnicity

Note 4: NA indicates unavailability or inapplicability

A comparison between sample demographics and the *SU Enrollment Survey Report for fall 1998* showed a high level of representativeness, particularly with regard to representation of gender, each academic class, nationality (international students were over-represented in the sample), and several schools including Arts and Sciences, Education, Management, Maxwell, and Public Communications. The study's small sample size (N=142) and the context in which these Web sites was developed and used does not allow for generalizability of findings to all the student population of Syracuse University at all times nor to all course Web sites offered at SU. Findings are more appropriately generalizable to a population of approximately 920 students enrolled in the specified nine classes during the fall of 1998. Findings about the Web site may only be generalizable to course Web sites made available through the faculty Web server during the fall of 1998. However, the findings are transferable to similar contexts where course Web sites are being used. The following observations are worth noting in relation to generalizability of findings to the two units of analysis in this study (a) students and (b) course Web sites:

a) Student Representativeness:

The study findings are not generalizable to the graduate student population due to small sample size of graduates represented in the sample. The findings about the course Web sites are not generalizable to undergraduate student population attending Syracuse University's College of Nursing and School of Social Work since none were represented in the sample.

- Similarly, the study under-represented the student population in the Schools of Architecture and Information Studies and Colleges of Engineering and Computer Science and Human Development. It is worth noting that these schools and

colleges were not well represented, if at all, in the Web site sampling pool to begin with.

b) Web site Representativeness

- The findings related to the SUNY-ESF course Web site are not generalizable to SUNY-ESF course Web sites since this is an atypical Web site in that it was the only SUNY-ESF functional Web site available on the faculty server at the time the data was collected.
- Students' perceptions of their course Web sites are limited to a context where these Web sites are offered as supplementary instructional resources rather than stand-alone or as part of online distance education.
- The course Web sites may no longer be representative of Web sites on the SU faculty server as this data was collected in the fall of 1998. Each course Web site continues to evolve every semester.

3.4.2.4 Increasing Response Rate

A low response rate in a survey frequently accounts for poor interpretation of final results, whereas an acceptable response rate for a general survey could range from 30% (Fowler, 1993) to 50% (Dillman, 1978). In order to increase the response rate, great effort went into the design of the questionnaire and its administration following the guidelines of Dillman (1978). The following steps were undertaken to increase response rate:

a) Questionnaire Design

In terms of look and feel, the questionnaire was field-tested with three students representative of the sample. In addition, various bright colors were used to increase appeal and also to facilitate coding of data by class and keeping track of responses. A

picture of a papyrus bookmark, offered as a promised raffle prize, was placed on the cover page of the questionnaire.

b) Pilot Studies

Several methods were field-tested to confirm the final method of data collection and administration including: e-mail, Web-based online forms, campus-mail, regular mail, and in class administration. It became evident that in-class administration yielded the highest response rates but had to be rejected because this necessitated taking 20-30 minutes of class time. Online surveys using Web forms were found to be risky, unfamiliar to students, and an unreliable means of gathering data particularly when respondents are novice users of the technology or simply do not use it. Therefore, to avoid response bias of this nature, Web surveys were not used. During the pilot, e-mail attachments yielded a response rate of 23% (N=30). Many students were having problems opening the files and/or sending them back. However, e-mail was resorted to for one-to-one follow up communications.

c) Administration

The survey was handed to each student personally by the author in class to reinforce its importance. Students were requested to mail back the questionnaires, which were enclosed in campus-mail envelopes with a return address so as to make it more convenient for students and at no monetary cost. Students were personally greeted by the author as they walked into class coupled with a 10-minute introduction to the survey that highlighted their roles as pioneers in this experience (see Appendix K for transcript). Verbal endorsement of the research study by the course instructors added to their openly expressed eagerness to better serve their students' academic needs using the technology, also served to give importance to the study.

c) Follow-Up

In spite of all the above, the initial response rate was only 37%[5]. As part of the follow-up efforts, several strategies were used. One-to-one e-mail follow-ups further established a connection between personal students' input and value of the research study. This was easy to do since students were initially requested to give their name and email address when they received a questionnaire. To avoid any problems with e-mail attachments experienced during the pilot study, students were informed that the author would be outside their lecture halls during a specified week so they could pick up another form, in case they had difficulty opening the attachment. The author was physically available during follow-up weeks near lecture halls collecting undelivered questionnaires, replacing lost ones, encouraging response from students who pointed out that they do not use the Web sites. Given the above experience in data collection, the impact of these efforts resulted in an initial 37% response rate that increased to 49.8% with a follow-up. Response rates are provided in Table 6 in chapter five.

3.5 Instruments

This section discusses the process of developing essential instruments for gathering data to answer the research questions. For each of these instruments, a brief summary is presented on the purpose, design and development, reliability and validity measures undertaken, as well as implementation procedures. The following is a listing of instruments developed by the author for this study.

3.5.1 Web site Instructional Design Evaluation Checklist (WIDEC)

[5] For comparative purposes, it is worth noting that a similar data collection method employed in 1994 by SU- *Center for Support of Teaching and Learning* (CSTL) also generated a 37% response rate (personal communications with Dr. Barbara Yonai- Assistant Director of Evaluation and Research, March 15th, 2000).

This is a 30-item checklist that was designed to screen course Web sites for final inclusion in the study. Three sets of courses were selected to reflect ranges of low, middle, and high in terms of instructional quality as determined by the nine events of instruction. The instrument was piloted and content validated. Interclass correlation during the pilot was (r=0.87). Details on the purpose, design, development, validation, and implementation of WIDEC can be found in [Appendix B].

3.5.2 Student Web site Perception Survey (SWPS)

SWPS is a 60-item questionnaire that was designed to measure students' perceptions of various Web site functions. The questionnaire [see Appendix C] consists of 6 sections: Section I elicits time spent on various functions, Section II elicits students' satisfaction with the course Web sites using open-ended questions that elicit perceived barriers to and facilitators of use and overall impact of the WWW. Section III elicits students' perceptions of the quality of Web site functions. Section IV elicits students' perceptions of the usefulness of various functions. Section V measures students' self-rated Internet skills, and Section VI elicits demographic data and characteristics. SWPS was content and face-validated by (a) experts in survey design, (b) three doctoral students with experience in instrument design, and (c) four student representatives and non-representative of the student sample. Ambiguities, wording problems, redundancy, scaling, and layout were revised. Construct validity was also conducted using factorial analysis. Cronbach's Alpha test for reliability and consistency was performed. Details on the purpose, design, development, validation, and implementation of SWPS are described in chapters four and five.

3.5.3 Faculty Survey

A 10- item open-ended questionnaire of purpose and expectations for having a course Web site was designed [Appendix D]. This instrument was piloted. Questions were revised to obtain the necessary information for triangulation purposes. Data from this survey was used to support the data or resolve any discrepancies in findings.

3.6 Analysis Framework

3.6.1 Summary of Factor Analysis

A confirmatory factor analysis technique was considered in this study over an exploratory factor analysis technique given that the dimensions, constructs, and items were all developed by the author using theoretical principles. While confirmatory factor analysis is used to assess the fitness of the theoretical model to the data (Pedhazur & Schmelkin, 1991), conventional factor analysis in this study resulted in confirming several items in each grouping originally created and therefore more sophisticated confirmatory factor analysis procedures were not deemed necessary as suggested by DeVillis (1991). A varimax rotation was used as a simple orthogonal rotation method that yielded meaningful item groupings and strong, unambiguous loadings (DeVillis, 1991). The following factors were found representative of the corresponding theoretical principles:

- ✓ **INTERACT** = time on task for communication and interactions with material [Gagné's events 1and 6, Chickering & Ehrmann's principles1,2,3, and 5] (T)
- ✓ **PREPARE** = the usefulness of functions that facilitate recall of prior learning, present new information, provide learner guidance, and enhance retention and transfer through enrichment and remediation [Gagné's events 3, 4, 5, and 9] (U)

- ✓ **GUIDE** = the usefulness of practice, elicitation, and feedback functions [Gagné's events 5, 6, and 7, Chickering & Ehrmann's principle 4] (U)
- ✓ **ATTITUDE** = the overall usefulness of the course Web sites and the extent to which students agreed that instructors' encouraged the class to use the Web sites (U)
- ✓ **APPEAL** = quality of visual and auditory elements and features that increase motivation for learning and are attention holding [Gagné's event 1 and 3] (Q)
- ✓ **PURPOSE** = quality of functions pertaining to clearly stating objectives and purposes, organization and importance of material on Web sites [Gagné's event 3 and 4] (Q)
- ✓ **SKILLS** = skills commonly used to connect to people or to other computers and accounts via e-mail, FTP, and Telnet [Flashlight Project Item Bank] (I)

(T) denotes Time Spent
(Q) denoted Quality
(I) denotes Internet Skills
(U) denotes Usefulness

The above factors were constructed conceptually and empirically: conceptually, drawing upon theoretical frameworks provided primarily by Gagné, Briggs, & Wager (1992) in the nine events of instruction, and the seven principles of good teaching and learning practices using technology as lever (Chickering & Ehrmann, 1996) and empirically using factor analysis and the mean of item factor loadings combined for each dimension represented. Table 4 shows a summary of dimensions with corresponding indicator measures, items for each indicator that loaded **>0.60** in factor analysis, and Cronbach Alpha.

Table 4
A Summary Table of Dimensions and Corresponding Indicator Measures, Items, and Cronbach Alpha Values

Dimensions	Corresponding Factor (Indicator)	Corresponding Items in SWPS with Factor Loading >0.60	Cronbach Alpha*
Time Spent	INTERACT	Q1,Q2,Q3,Q5,Q8,Q9,Q10	0.89
Instructional	APPEAL	Q15,Q16,Q18,Q19, Q27	0.80
Quality	PURPOSE	Q20,Q22,Q23,Q25	0.77
Usefulness	ATTITUDE	Q33,Q34	0.67
	PREPARE	Q35,Q44,Q45,Q46	0.78
	GUIDE	Q37,Q38,Q39,Q40,Q41,Q42,Q43	0.86
Skills	SKILLS	Q49a,Q49c,Q49f	0.70

* Cronbach Alpha of 0.70 standard value or higher is indicative of established reliability (Nunnally, 1978).

3.6.2 Index Construction

The purpose of index construction was to create an overall score for each indicator (factor). Following recommendations from factor analysts (Pedhazur & Schmelkin, 1991), for each indicator, an arithmetic mean is computed for all item scores (rated by the respondent) belonging to that factor. It is worth noting that items with missing values were not included in the mean computation of the index score. Second, taking into consideration the differences in item factor loadings, each item was weighted by its factor loading in the arithmetic calculation of the mean. Substituting a mean score for the missing item value was rejected because it does not change the result. In other words:

*sum(item score*item factor loading) / number of items = respondent mean index score*

A hypothetical example is provided for PREPARE in Table 5:

Table 5

Hypothetical Data Matrix[6] for PREPARE

	Q35	Q44	Q45	Q46	MEAN
Respondent 1	2(.63)	2(.80)	3(.83)	2(.78)	1.73
Respondent 2	1(.63)	3(.80)	2(.83)	2(.78)	1.41
Respondent 3	2(.63)	....	4(.83)	2(.78)	2.1
Hypothetical Mean Index Score for PREPARE					1.75

3.6.3 Data Coding and Cleaning and Missing Responses

Data coding, entry, and analysis were conducted by the author using the SAS™ statistical package. Data coding primarily used the actual Likert-scales used in the instrument with the exception of the NA items that were coded as "9" and later treated as missing responses. Also in the Time Spent index, the half-hour was coded as "8" and later converted to represent (.5) of an hour to allow for calculations of percentages. Zeros on the Likert scale were coded as (0). Data cleaning followed recommendations from Babbie on possible-code cleaning and treatment of missing responses (1992). Possible-code cleaning was conducted by checking errors of data entry. Handling missing data is necessary in index construction (Babbie, 1990). Babbie recommended several procedures including: (a) careful analysis of data for possible interpretation, (b) excluding respondents with missing data, and (c) treating the missing items in the same way as the other items. Each of these procedures was considered and only one respondent was excluded altogether. No meaningful patterns were found amongst missing responses. In addition *Not Applicable/Not Available/No Basis for Judgment*

[6] A similar table format in Tangmanee's (1999) dissertation study was adapted here for illustration purposes

(NA) and *Don't Know (DK)* responses were treated as missing values and were not included in computations except where noted.

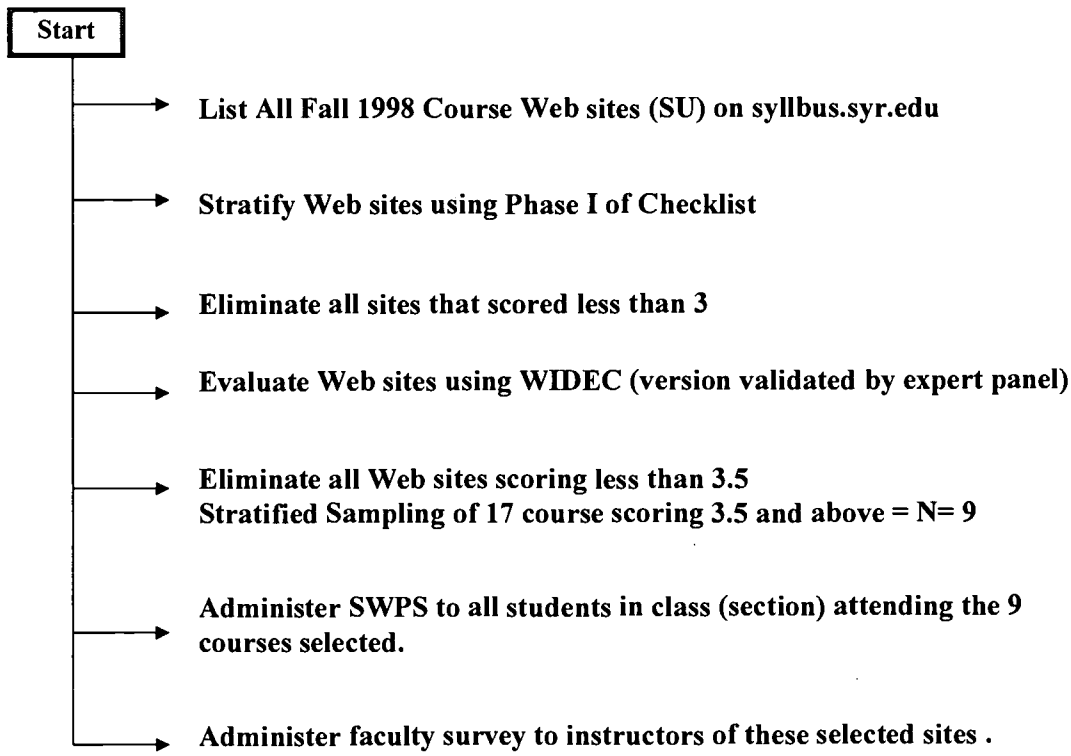
Qualitative and quantitative analysis methods were used to analyze data. Analysis of narrative data from open-ended questions on SWPS was based on Miles and Huberman (1994) framework for qualitative data analysis and the quantitative numerical coding scheme described in Babbie (1989). The open-ended responses from the questionnaire were coded using categorization and analysis of data to identify emerging patterns and themes. Each response generated from the open-ended questions was coded by individual respondent and by course. Then patterns were identified and assigned a code. This code was then examined for its frequency of occurrence in relation to other codes using percentages. Quantitative data was analyzed using both descriptive and inferential statistics. Frequency distributions, percentages, means, standard deviations, were computed to obtain descriptive statistics. Further interpretation of the data required the use of statistical tests such as Pearson's product moment correlations, simple regression analysis, ANOVA, factor analysis and Cronbach's Alpha.

3.7 Chapter Summary

This chapter has delineated and discussed how the proposed study sought to document, analyze, and develop an understanding of college students' reported experience of the use of the World Wide Web as an instructional resource. In this chapter, specific procedures and rationale for survey methods were discussed. Figure B depicts a flow-chart that summarizes data collection procedures. The proposed study employs a self-administered survey for data collection. An effort was made to develop a questionnaire that would yield reliable and valid responses. Measures were also taken to

increase the response rate. Data were collected from nine classes offered during the fall of 1998 on the Syracuse University campus. These classes are cross-disciplined and therefore varied in terms of subject matter, level of difficulty, instructional methods employed, and student population characteristics. The intent was to increase variation in findings by sampling from a diverse pool of students in terms of their discipline of study and academic standing in addition to other demographics and other contextually relevant characteristics. Thereby, this further illuminates on current WWW technology integration efforts through empirical findings.

Figure B A Flow Chart Illustrating Data Collection Procedures



CHAPTER FOUR

The Development, Validation, and Implementation of SWPS

4.1 Introduction

As pointed out in chapter two, at the onset of this study there were only a handful of studies that examined students' perceptions of instructional Web sites. As yet, there are no initiatives to study the phenomenon of campus-wide course Web sites used as instructional resources for campus-based courses. While this study is primarily a case study of one private university faculty initiatives and student perceptions, concern with a representation of students across and within disciplines led to the utilization of survey design methods. The Student Web site Perception Survey (SWPS) is a theory-based instrument designed to gauge students' perceptions drawing upon a theoretical framework (see Figure A) based on principles of instructional design and recommendations from research on good teaching and learning practices using technology as a lever. In particular, SWPS attempts to gauge the instructional quality and usefulness of a range of course Web sites that are representative of multi-disciplines and are wide-ranging in sophistication of design.

4.2 Purpose of SWPS

SWPS was designed to facilitate students' reporting of their perceptions of their course Web sites [See Appendix C for questionnaire]. Data from one-hour interviews with students revealed limited expressions on behalf of students in describing their

experience in using the course Web sites. The instrument provides respondents with an elaborate set of guidelines for judgment of the value of the phenomenon of study. Elicited responses were guided by four dimensions: (a) time spent on certain Web site functions as indicator of use, (b) judgments of the instructional quality of functions, (c) perceptions of usefulness, and (d) barriers to and facilitators of use and overall impact on students' learning experiences.

4.3 Design and Development of SWPS

Initially, exploration of students' experiences with the WWW as a course resource began with the administration of a written questionnaire. This questionnaire was developed by the author after examination of several existing instruments developed including the *Motivational Analysis Checklist* (WebMAC) (Small, 1997), *Keller's Motivational Tactics* Checklist (Keller, 1989), the *Flashlight Student Inventory Item Bank*, (Flashlight Project, 1997), and *WIDEC* [See Appendix B]. It is worth noting that several pilot questionnaires were administered between 1996-1998 prior to the final pilot questionnaire administered in the fall 1998. These earlier versions assisted in refining and grounding the final research questions for the current Student Web site Perceptions Survey (SWPS). The research questions provided the framework for designing the questionnaire. SWPS consisted of several forced-choice questions and four open-ended questions. As stated above, several dimensions guided the operationalization of these research questions that were represented in the questionnaire in six sections: The forced-choice items were measured using likert-type scale ranging from 0-7. Each section is summarized below in Table 6 and described next in greater detail.

Table 6

Summary of the Dimension, Outcome Measures, and Corresponding Items in SWPS

Dimension by Section in SWPS	Outcome Measures	Corresponding Items in SWPS*
I – Time Spent (T)	Time Spent on various Web course functions	Q1-Q11
II - Satisfaction (S)	3 Greatest barriers to use of Web site	Q12
	3 Greatest help to use of Web site	Q13
	Perceived impact of WWW on learning experience	Q14
	Overall comments on use of Web site	Q60
III- Instructional Quality (Q)	Perceived appeal of motivational functions	Q15-Q20
	Perceived PURPOSE of statement of Web site objectives	Q21-Q23 Q30
	Perceived organization of presentation of information	Q24-Q29
	Perceived support provided by enriching and remediating functions	Q31-Q32
III Usefulness (U)	Perceived usefulness of various functions on the Web site including recall, performance elicitation, practice, and feedback, enhancing retention and transfer	Q33-Q47
IV- Internet Skills (I)	e-mail, WWW searches, FTP, Telnet, Programming, years of access, and creating Web pages	Q49-Q48
VI - Demographics (D)	Class, age, sex, age, GPA, nationality, major, etc..	Q50-Q54, Q59
VI - Characteristics (C)	Access to computers, modem speed, type of connectivity, residential proximity, reasons for taking course, distance, etc.	Q55-Q58

Section I - Time Spent (T) - Students reported time spent on specific functions on the Web sites.

Section I in the questionnaire attempted to measure the time allocated on a typical week to specific functions provided on the Web site. A 7-point Likert-type scale was used to measure perceived time spent in hours per week over a one-semester period of time. This section addresses time spent on task and overall use of specific functions on the Web sites. This question was considered important given that it has been previously reported that use of technology in higher education is on the rise, for college instruction in particular (Green, 1996). Items for this index were drawn and adapted from the Flashlight Student Inventory Item Bank (Flashlight Project, 1997). Content validation for this section of the SWPS was initially based on that reported for the Flashlight Projects' Current Student Inventory (CSI).

According to the project handbook (1998) the CSI was subjected to content validity testing. Initially, 2000 students responded to the first version of CSI. This was followed by an 18-month series of focus groups with students, faculty, and administrators from the five Flashlight participating higher education institutions. Meetings were held to discuss the extent to which respondents liked the items and agreed upon their interpretation. Items were revised to correct any ambiguity problems, and to include suggestions made toward their improvement. Based on Flashlight recommendations, when creating the survey for this study, care was taken to retain as much of the wording of the items from the CSI as possible. However the order and context in which they were administered, were changed by the author and therefore

validity was compromised in this respect. However, a factorial analysis was computed on these items to establish construct validity.

Section II - Satisfaction (S) - Students' perceived satisfaction with course web site

The second section of the questionnaire consisted of four open-ended questions which attempted to tap into the feelings and thoughts of students as they engage in this learning experience. Student satisfaction is a necessary criterion for effective instruction (Dick & Reiser, 1989; Keller, 1987a, 1987b, 1987c). The open-ended questions were designed to elicit students' perceived satisfaction with the technology in terms of overall opinion, the three greatest barriers to the use of the course Web site, the three most helpful factors that contributed to use of the course Web site, and the impact of the technology on their learning experiences. The section addresses the question investigating influential factors on students' perceptions.

Section III - Instructional Quality (Q)- Students' perception of instructional quality of specific functions on the Web sites.

Section three of the questionnaire examines the complexities instructional quality of the Web site using evaluation criteria drawn from these principles of instructional design. This section addresses the perceived quality question in the study that explores students' perceptions of the quality of certain functionalities of their course Web sites. Items for this index were created using WIDEC items based on Gagné, Briggs, and Wager's (1992) nine events of instruction as use and reworded to suit student language [Appendix B – 2 lists Gagné's nine events and corresponding WIDEC and SWPS Items]

Section IV - Usefulness (U) - Students' perceived usefulness of certain instructional activities on the course Web sites.

4.4 Validating SWPS

Validation of the instrument will primarily address content and construct validity (Huck and Cormier, 1996). Drafting the survey following several recommendations (Babbie, 1992; Dillman, 1978) in order to attract a survey respondent and thereby enhance reliability and validity of questionnaire items. These recommendations also increase the response rate. Content and face validation was achieved through various strategies: field-testing, pilot-testing, and expert reviews. Construct validation and internal consistency of items in each category were achieved using statistical tests such as Factor Analysis.and Cronbach's Alpha respectively. Next, is a summary of these procedures for validation.

4.4.1 Statistical Testing

Huck and Cormier (1996) also recommend factor analysis as suitable for construct validation. Factor analysis is a powerful tool of construct validation (Kerlinger, 1986). Factor analysis was used for construct validation purposes and to derive outcome measures to further operationalize four dimensions from the above listed in Table: *Time Spent* (T), *Instructional Quality* (Q), *Usefulness* (U), and Internet skills (I).

For each of these four constructs, only items that loaded **(>0.60)** were selected and labeled to reflect the combined characteristics of the items loadings. Factor analysts suggest that only a factor whose eigenvalue is greater than one **(>1)** be extracted and retained for the next steps of factor analysis (Harman, 1976). While factor loadings of 0.40 to 0.50 are considered acceptable (Pedhazur & Schmelkin, 1991), in this study, this standard seemed low by comparison of other item factor loadings. Theoretical underpinnings were drawn upon to further explain item loading on any of these factors.

Particularly, the nine events (Gagné, Briggs, & Wager, 1992) and the seven principles of good teaching practices using technology as lever (Chickering & Ehrmann, 1996) were used to match items for each derived measure with a corresponding event where possible. Table 7 shows item factor loadings, eigenvalues, communality estimates, and variance percentages, and Cronbach Alpha coefficients for each category of items designed to represent each dimension. Each of the derived factors were subsequently used for analysis of data and are summarized in section 3.6 and were discussed in chapter five.

Table 7

Summary of Items and Factor Loadings for Varimax Orthagonal Two-Factor Solution for Q1-Q10 (N=142) With Coefficient Alpha, Eigenvalues, Percentages of Variance for Factors

Time Spent

Coefficient Alpha* = 0.85 (standardized)

Item	Factor Loadings		Communality
	1	2**	
	INTERACT		
Q1	**0.66**	0.05	0.43
Q2	**0.83**	0.13	0.71
Q3	**0.67**	0.16	0.47
Q4	0.37	0.42	0.32
Q5	**0.79**	0.21	0.67
Q6	-0.05	0.76	0.58
Q7	0.00	-0.63	0.39
Q8	**0.84**	-0.11	0.71
Q9	**0.86**	0.00	0.74
Q10	**0.85**	0.15	0.74
Eigenvalue	4.5	1.2	
% of Variance	4.5	1.3	

*Coefficient Alpha for all items ** This factor was not used due to lack of conceptual meaningfulness
Note1: Boldface indicates highest factor loadings.
Note 2: Item description is available in Appendix SWPS

(Table 7 continues)

Table 7 Continued

Summary of Items and Factor Loadings for Varimax Orthogonal Two-Factor Solution for Q15-Q32 (N=142) With Coefficient Alpha, Eigenvalues, Percentages of Variance for Factors

Instructional Quality

Coefficient Alpha* = 0.90 (standardized)

Item	Factor Loadings		Communality
	1	2	
	APPEAL	PURPOSE	
Q15	**0.85**	-0.24	0.77
Q16	**0.69**	-0.04	0.85
Q17	0.10	0.05	0.73
Q18	**0.82**	0.12	0.79
Q19	**0.75**	0.22	0.62
Q20	0.08	**0.76**	0.59
Q21	0.27	0.54	0.67
Q22	0.05	**0.73**	0.62
Q23	0.04	**0.60**	0.72
Q24	0.57	0.50	0.72
Q25	0.05	**0.76**	0.69
Q26	0.39	0.54	0.68
Q27	**0.79**	0.27	0.75
Q28	-0.00	0.31	0.72
Q29	0.07	0.55	0.65
Q30	0.17	0.35	0.72
Q31	0.08	0.00	0.78
Q32	-0.02	0.09	0.78
Eigenvalue	5.9	2.8	
% of Variance	3.7	3.6	

*Coefficient Alpha for all items
Note1: Boldface indicates highest factor loadings.
Note 2: Item description is available in Appendix SWPS

(Table 7 continues)

Table 7 (Continued)

Summary of Items and Factor Loadings for Varimax Orthogonal Three-Factor Solution for Q33-Q47 (N=142) With Coefficient Alpha, Eigenvalues, Percentages of Variance for Factors

Usefulness

Coefficient Alpha* = 0.89 (standardized)

Item	Factor Loadings			Communality
	1	2	3	
	GUIDE	PREPARE	ATTITUDE	
Q33	-0.22	0.16	**0.89**	0.94
Q34	0.14	0.12	**0.80**	0.90
Q35	0.51	**0.63**	-0.03	0.75
Q36	-0.06	0.24	0.0	0.98
Q37	**0.85**	0.14	-0.17	0.82
Q38	**0.76**	0.52	0.08	0.86
Q39	**0.93**	0.27	-0.07	0.97
Q40	**0.90**	0.08	-0.07	0.93
Q41	**0.91**	-0.06	0.06	0.89
Q42	**0.81**	0.09	0.40	0.95
Q43	**0.77**	0.33	0.46	0.92
Q44	0.25	**0.80**	0.41	0.98
Q45	0.27	**0.83**	0.29	0.90
Q46	0.29	**0.78**	0.35	0.83
Q47	-0.21	0.14	0.39	0.78
Eigenvalue	7.3507	2.8965	1.7647	
% of Variance	5.7	3.8	2.3	

*Coefficient Alpha for all items
Note1: Boldface indicates highest factor loading of item.
Note 2: Item description is available in Appendix SWPS

(Table 7 continues)

Table 7 (Continued)

Summary of Items and Factor Loadings for Varimax Orthogonal Three-Factor Solution for Q48-Q49a-f (N=142) With Coefficient Alpha, Eigenvalues, Percentages of Variance for Factors

Internet Skills

Coefficient Alpha* = 0.89 (standardized)

Item	Factor Loadings		Communality
	1 SKILLS	2++	
Q48	-0.03	**0.62**	0.38
Q49a	**0.72**	0.17	0.54
Q49b**	0.48	0.52	0.50
Q49c	**0.76**	0.25	0.64
Q49d	0.29	**0.69**	0.56
Q49e**	0.52	0.47	0.50
Q49f	**0.68**	-0.46	0.68
Eigenvalue	7.3507	2.8965	
% of Variance	5.7	3.8	

*Coefficient Alpha for all items
** These items were excluded due to low factor loadings
++ This factor was ignored because it has no conceptual meaning
Note1: Boldface indicates highest factor loadings of item
Note 2: Item description is available in Appendix SWPS

Based on the above results of the factor analysis and the Alpha Coefficient of internal consistency, the following conclusions were drawn:

- Items with low factor loadings **(<0.60)** were ignored and removed from subsequent analysis.
- Conceptually derived constructs (e.g. PRESENT and ENRICH above) that were not confirmed by factor analysis, were not used in subsequent analysis even though the

internal consistency of the items was consistently high (ranging from 0.75-0.90). According to Babbie (1992), one of the disadvantages of factor analysis is that factors can be generated on a group of disparate variables without regard to substantive meaning (1992). Given the theoretical grounding of this factor analysis provided the rationale for discarding. Similarly, the author would rather not undermine the strength of theoretically derived and empirically tested constructs and recognizes the usefulness of subsequent revisions of the instrument by increasing the number of items and ultimately their power.

4.4.2 Reliability Testing

As mentioned above, reliability is the degree of consistency of measured performance across repeated testings (Huck & Cormier, 1996). While, Huck and Cormier (1996) recommend several approaches to reliability such as the coefficient of stability (Test-Retest) or the Alternate-Forms reliability, both these types do not seem feasible for this study. The reliability coefficient or the coefficient of internal consistency of the questionnaire items was considered a more appropriate test. According to Huck and Cormier (1996), instead of focusing on stability across time or on equivalence across forms, the test of internal consistency assesses the degree to which the items in the instrument are internally consistent. Internal consistency is defined as:

> ...consistency across the parts of a measuring instrument, with the "parts" being individual questions or subsets of questions. To the extent that these parts "hang together" and measure the same thing, the full instrument is said to possess high internal consistency reliability. (p. 78-79)

Similarly, Pedhazur and Schmelkin (1991) refer to internal consistency reliability as to how consistent the questionnaire items capture the variation in the variable. While there are several other procedures, this test is best suited for the study because it is more versatile than any of the others in that it can be used with instruments made up of items that can be scored with three or more possible values (Likert-type scales). The other procedures are more favorable when using dichotomous values. Cronbach's Alpha is a measure of internal consistency for items that are not scored dichotomously (Borg and Gall, 1983). Since the questionnaire employed a four-point to seven-point Likert-type scale, Cronbach's Alpha could therefore be used to determine the reliability of these scales.

Table 8 illustrates the reliability rate for items belonging to the four dimensions: *Time Spent, Instructional Quality, Usefulness, and Internet Skills*. Each of the derived construct measure from the factor analysis presented above was also tested for reliability. For exploratory research such as this study, traditionally, a Coefficient Alpha's in range of **(0.70)** is considered acceptable. In this study, almost all but the ATTITUDE had Alpha coefficients higher than the 0.70. The ATTITUDE index (0.67) was not discarded nonetheless, given the close to 0.70 score and the non-life threatening nature of the phenomenon understudy (Babbie, 1992, Pedhazur & Schmelkin, 1991). Table 18 also depicts results for items that were conceptually grouped based on the constructs stated earlier.

Table 8

Results Of Cronbach's Coefficient Alpha Reliability Test for Items Belonging to 4 Main Dimensions: Time Spent, Quality, Usefulness, and Internet Skills and Items Belonging to their Corresponding Indicators

Dimension Indicator	Items	Cronbach Alpha*
Time Spent	Q1-Q10	0.85
INTERACT	Q1,Q2,Q3,Q5,Q8,Q9,Q10	0.89
Quality	Q15-Q32	0.90
APPEAL	Q15, Q16,Q17,Q18,Q19,Q20	0.73
PURPOSE	Q21,Q22,Q23,Q30	0.80
PRESENT**	Q24,Q25,Q26,Q27,Q28,Q29	0.80
ENRICH**	Q31,Q32	0.75
Usefulness	Q33-Q47	0.89
ATTITUDE	Q33,Q34	0.67
PREPARE	Q35,Q44,Q45,Q46	0.78
GUIDE	Q37,Q38 Q39,Q40,Q41,Q42,Q43	0.86
Internet Skills	Q48-Q49(a-f)	0.76
SKILLS	Q49a,Q49c,Q49f	0.70

* Cronbach Alpha of 0.70 standard value or higher is indicative of established reliability.
** Two derived variables based on theory, originally created in SWPS but were not confirmed by factor analysis so were excluded from subsequent analysis.
d) Note: Shaded area shows alpha for all items included in SWPS by Category

4.4.3 Field Testing

Field testing the Questionnaire constitutes, according to Dillman (1978), a pre-test that includes respondents from three distinct groups. These three are (a) those with similar training as the author conducting the survey; (b) those with substantive knowledge in survey or subject matter; and (c) those with similar skills or conditions as those of the population under study. To begin with, the author's dissertation committee reviewed the survey based on their expert judgment as having both methodological and subject-matter expertise. In addition to several classmates and colleagues, four experts in survey research methods, statistics, and content were consulted on the face and content validity of the questionnaire [see Appendix C - 1 for letter of Reviewers of SWPS].

Four students representing the age among other population demographics of the intended student sample were selected from campus to respond to the instrument. Three of these students were interns at SU but went to schools other than SU and their reviews helped to clarify any contextual ambiguities. A half-hour debriefing session followed after their completion of SWPS. Structured interview questions that were asked of the respondent during the debriefing session. The purpose of the debriefing session is to identify any ambiguity, problems, and suggestions for improvement. The form used for debriefing sessions for both experts and students is in [Appendix C - 2].

4.4.4 Pilot Testing

Finally, as a culminating activity in the validation process, a pilot test was conducted during the summer with two classes that were offered during the summer 1998. One is an online course in Psychology while the other is a course on the Internet for Educators.

Student enrollment is approximately 25 for each class. In both cases the questionnaire was mailed to the students. The Psychology group received it online via e-mail and returned it in the same manner. The Internet group received their survey and returned it by postal services. There were several shortcomings for this pilot that the author became aware of and took into consideration when administering SWPS.

One of the shortcomings of the summer pilot study was that it was conducted in the summer and student demographics changes significantly from the typical one during the academic year. Several students in this sample were staff employees or non-degree students. Secondly, the courses themselves were typical summer courses that were designed to attract a typical student population. Other confounding variables were the method by which data was administered and collected. The Internet group received the questionnaire through postal delivery in a self-addressed envelope, while the Psychology group communicated through electronic mail. This difference did not affect the response rate as much as was expected. Both methods demanded a lot of work in terms of follow up. However, this experience confirmed for the author that campus-mail, which was used in an earlier pilot study, was the most efficient, reliable, and cost-effective method of data collection.

Besides, the timing of data administration was also considered. The author learned that the survey should not be administered around exam periods or toward the end of the semester. For example, the Internet class received the questionnaire after they had completed the class, whereas the Psychology class received the survey on the last week before class was over. Follow up phone calls to the Internet class showed that the time lapse might have made a difference in terms of recall and reaction. Hence, it is

better that one sends out the survey before classes are over. Finally, another crucial variable to consider is the negotiation that takes place with the course instructor prior to administering survey. Some faculty preferred to determine the manner and the time period when the survey should be administered. While this makes it more convenient and perhaps more rewarding in the long term, it does confound standardization of survey administration. In the pilot, both instructors endorsed the survey with a letter addressed either personally to the student, or through the class listserv.

4.5 Administering SWPS

A letter of invitation was first sent out to the course instructor inviting him or her to participate in the study and to allow his/her class to be included in the sample in [Appendix C – 3]. Final, administration of the student questionnaire was conducted by the author. Once the classes to be included in the sample were identified, the author e-mailed the course instructor and sought permission using the faculty consent form in [Appendix C - 4]. The questionnaire was distributed to all students attending class on that day. Each questionnaire and an informed consent form were enclosed in campus-mail envelope with a return address. Students were requested to mail them within two weeks.

Students sampled were given a questionnaire as they approached the lecture hall. The author would be standing at the entrance, as students filtered in. In cases where there was more than one entrance to the lecture hall, the author requested assistance from a friend to co-distribute the questionnaire after having received instructions accordingly. Students generally tended to gradually filter in singles, pairs or groups of three, which made the administration process manageable. As students filtered in, care was taken to briefly inform students that this was a survey sample not related to any course

requirement or activity. This was important since some students *did* want to know if they should have received a questionnaire or were missing something related to class. The author also had to make judgment calls in terms of not distributing questionnaires to students who informed us that they already received SWPS in another class. In this situation, questionnaires were re-issued to close-by alternates. This also was the case when some students said that they were too busy at that time, or the one or two who happened to leave their questionnaires behind after class or simply dropped them. The author always stayed until the end of class, because the last 10 minutes were given up by the instructor for the introduction to the study and purpose of the questionnaire, and directions on where to send the questionnaire. On some occasions, however, the 10 minutes were at the beginning of class.

[Appendix C - 5] contains a copy of the transcription read out to students.

4.5.1 Timeline for Data Collection

Administration of SWPS was scheduled on the last week of October 1998 and first week of November 1998 after having taken into consideration the following:

a. The last date to drop and add a course had passed;
b. Mid-term Exams were over for each class scheduled;
c. This time of the semester was timely for data collection based on negotiations between researcher and course instructors on where students are in their learning process.

4.5.2 Obtaining Informed Consent

Consent was obtained from three main entities: the Syracuse University Institutional Review Board (IRB), the faculty who taught the classes participating in the study, and the participants themselves. The following steps were undertaken:

1. The Institutional Review Board at Syracuse University had been notified, necessary documents submitted, and approval was obtained [See Appendix C – 6].
2. Consent was also requested from faculty offering these classes. An e-mail request was sent out to each faculty member and a subsequent follow-up letter on official departmental letterhead was mailed through campus. An office visit was also made for those who request it and a copy of the questionnaire was sent to those who expressed an interest in seeing it. Follow-up e-mails, phone calls, and/or office visits were made to ensure consent was obtained and the procedure for data collection was not considered intrusive to the faculty [See Appendix C – 4 for Faculty Consent Form].
3. Participant consent forms were handed out with the questionnaire for students to sign [Appendix C - 7].
4. A "Thank You" card was sent to each participating faculty a week after data collection.
5. A papyrus painting was presented to each participating faculty and TA as a token of appreciation for their support and encouragement.
6. A "Thank You" note was sent out to all students through a class listserv or on their course Web site. A papyrus bookmark was sent out to each student who participated in the survey.

7. A summary report of findings from the study will be mailed to each participating faculty member upon their request.

4.6 Chapter Summary

This chapter described the procedures involved in designing and developing a questionnaire. SWPS is a theory-based instrument designed to measure primarily the usefulness and instructional quality of course Web sites. In addition, the instrument also gauges time spent by students on individual functions; barriers to and facilitators of use of course Web sites; and overall impact as perceived by students using these course Web sites. The purpose of the questionnaire was to facilitate students' reporting of their perceptions of their learning experiences of their use (or lack) of their course Web sites. SWPS was construct validated using factor analysis which resulted in confirming five constructs where item factor loading >0.60. Item consistency was measured for reliability using Cronbach's Alpha where item clusters had a range of r=0.085 – 0.90. Details of instrument field and pilot testing, in addition to administration procedures and timelines brought chapter five to a close.

CHAPTER FIVE

Results

5.1 Introduction

This chapter presents the results that answer the questions: (1) How did students allocate their time using their course Web sites? (2) What was the quality of the course Web sites according to students? (3) How useful did students perceive their course Web sites? (4) What demographics and characteristics influenced students' use and perceptions of quality and usefulness of course Web sites? (5) What were some student reported barriers to and facilitators of use of the course Web sites and overall impact of the WWW on students' learning experiences?

The first section of this chapter presents a summary of response rates. The second section describes the demographics and characteristics of the study sample. The third section presents data regarding students' reported use of various functions of their course Web sites on the *Time Spent* (T) dimension represented by INTERACT. This includes interaction with materials on the course Web sites and communication functions (peers, faculty, teaching assistants, and other experts). Students' judgments of the quality of the course Web sites are reported in the fourth section. Quality is represented by two indicators. The first pertains to appeal and motivation for learning (APPEAL). The second pertains to clarity of objectives and Web sites' purposes, organization of course Web sites, and importance of materials on the Web sites (PURPOSE). These indicators represent the *Instructional Quality* dimension (Q). The fifth section reports students' perceptions of the usefulness by three indicators: a) functions including online practice,

elicitation, and feedback (GUIDE); b) functions that facilitate recall of prior learning and enhance retention and transfer through remediation and enrichment (PREPARE); and c) students' overall attitude toward the usefulness of their course Web sites including their perception of instructors' encouragement to use a course Web site (ATTITUDE). These three indexes represent the *Usefulness* dimension (U). The sixth section presents findings of statistical relationships among various demographic variables and characteristics including the (SKILLS) index. The results provide insights into student demographics and characteristics that may have influenced students' perceptions of their usefulness and quality of their course Web sites and the time spent on various functions. The final section of this chapter presents summary findings of the narrative open-ended data addressing students *Satisfaction* (S) with overall experience within the context of perceived impact, barriers to and facilitators of use of the course Web sites that serve to contextualize interpretations of the above findings.

The data were analyzed statistically using the SAS™ package. The level of significance, in all cases throughout the analysis, was set at a minimum alpha level of 0.05. Pearson product moment coefficient and various descriptive statistics such as frequency distribution, means, standard deviations and percentages were used to analyze and report the data. Inferential statistics were also computed including ANOVA and simple regression.

5.2 Response Rate Results

Data were collected during the fall of 1998. The study sample consisted of 142 respondents drawn from nine on-campus courses that had a course Web site. Approximately 30% of the total student population registered for these 17 classes

(N=920) were sampled from the 9 classes that made the final WIDEC screening. Of this sample (N=285), 49.8% responded (N= 142). As explained earlier in section 3.4.2.2, in large classes, 40 questionnaires were handed out to students at the classroom entrance. Every *nth* student entering the class was handed a questionnaire. Variations of *n* occurred based on calculations of total number of students divided by 40. In smaller classes, all students attending class that day received a questionnaire. Table 9 categorizes the response rate in frequencies and percentages.

Table 9

Response Rates in Percentages by Course and for Total Sample[7]

Course ID*	Course Title	Student Sample Size (in relation to total class size)[8]	*f*	% of Response Per Course	% of Response for Total Sample
BIO 400	Immunobiology	40/89	28	70	19.7
ECN 200	Economic Ideas and Issues	40/99	13	32.5	9.2
FOR 300	Introduction to Soils	40/103	21	52.5	14.8
HST 100	Introduction to American History	40/185	15	37.5	10.6
PAF 100	Introduction to Public Affairs	40/151	21	52.5	14.8
PHY 200	General Physics	40/240	14	35	9.9
SPP 500	Phonation Disorders	20/21	7	35	4.9
WRT 100	Freshmen Writing	14/14	13	92.9	9.2
WRT 300	Studio Writing	11/18	10	90.9	7.0
Total		**285/920**	**142**		**100%**

* Course ID numbers changed for anonymity

5.3 Summary of Student Demographics and Characteristics

According to Babbie (1992), knowledge of the respondents is a necessary step prior to conducting analysis because this provides the context for performing the main analysis and for interpretations of the results. [Appendix F includes summary tables and detailed narrative of data characteristics and demographics]. A typical student of the study sample would be a 20 year old American female, of junior academic standing with a GPA of 3.3. She is most probably taking the course as a requirement. She lives on Syracuse University's North Campus.

She has access to a computer on a regular basis and uses campus terminals for Internet access through an Ethernet connection rather than dial-in. She has been using the WWW for two to three years.

[7] All numbers in % are rounded off to the nearest decimal point.
[8] Total class size figures are based on official school registration records and not actual number of students attending on day of data collection.

She considers her Internet skills overall to be low to medium. More specifically, her best skills are in using e-mail, followed closely by medium to high skills in searching the WWW. She has low to medium skills in the use of telnet and FTP. Her lowest skills are in programming and creating or editing Web pages.

5.4 Question # 1

How did students allocate their time using their course Web sites?

This section presents and discusses findings regarding percentage of users and non-users of various functions of the course Web sites (specifically, the amount of time students allocate to each given function in a typical week). In order to answer this question, a *Time Spent* category (Questions 1-10, Alpha = 0.85, and 11 as open-ended) was constructed from these items included in the student Web site perception survey (SWPS, see Appendix C). Using a 7-point Likert-type scale (NA, 0, 1/2 hour, 1, 2, 3, 4+ hours), students were asked to report how much time they spent on using their course Web sites, in a typical week during the semester. Items for this section of SWPS were drawn from the Flashlight CSI section relevant to *Technology Use*, which are based on the seven principles as the theoretical basis. INTERACT was confirmed by factor analysis and used to create indexes for *Time Spent (T)* (see section 3.6.2 for index construction). The items are listed in Table 10.

5.4.1 Student Reported Use of Web site Functions

Table 10 depicts results in percentages of users versus non-users of these functions in rank order by percentages. As can be seen from Table 10 below, there were two main categories of functions used by a large proportion of students: (a) interacting with material and (b) communicating with peers, faculty, and teaching assistants.

Table 10

Percentage of Users and Non-Users per Function in Rank Order by Users

Function	n	% Users	% Non-Users	% Who Stated Function N/A
Q1. Searching the WWW to access reference materials and/or conduct research for the course.	141[9]	78	17	5
Q2. Downloading/printing information from the course Web site.	142	72.6	24.6	2.8
Q5. Picking up or completing assignments on the course Web site.	142	58.1	31	9.9
Q9. Communicating with the course instructor/ teaching assistant(s), via e-mail, to make a suggestion/ complain/ask questions about the course.	142	52.8	43.7	3.5
Q3. Viewing a multi-media presentation/lecture notes on the course Web site.	142	45.8	36.6	17.6
Q4. Viewing slides or pictures on the course Web site.	142	39.5	37.3	23.2
Q8. Communicating with other students, via e-mail/listserv/hypermail/Chat, etc. to discuss the ideas and concepts taught in the course.	142	38.7	51.4	9.9
Q10. Communicating with content experts outside your college or University via e-mail or through the course Web site via hypermail or Chat.	142	15.2	67.6	16.2
Q6. Taking an online quiz through the course Web site.	142	14.8	40.8	44.4
Q7. Creating or updating a home page on the WWW.	142	8.2	51.4	39.4

5.4.1.1 Functions with the highest percentages of users

The function with the *highest* percentage of users is searching the WWW to access reference materials and/or conduct research for the course (Q1,78%). The second function with the largest percentage of users is downloading/printing information from the course Web site (Q2, 72.6%). Furthermore, two other functions were used by more than half the sample. Picking up or completing assignments on the course Web site ranked as the third function with highest usage (Q5, 58.1%) and communicating with the course instructor/Teaching assistant(s), via e-mail, to make a suggestion/complain/ask

questions about the course (Q9, 52.8%). These communication functions illustrate interactive use of the course Web site. These findings may support the claim that the WWW has interactive capabilities that particularly facilitate communication amongst groups (Dills & Romiszowski, 1997; Ehrmann, 1997a; Khan, 1997; Turoff, 1997). These findings also support expectations of the strengths and attributes of the WWW as a research tool given that it is currently the largest electronic repository of information.

5.4.1.2 Functions with the highest percentages of non-users

The functions that appeared to have been *least used* were taking an online Quiz through the course Web site (Q6, 14.8%) and creating or updating a home page on the WWW (Q7, 8.2%). A closer examination of the data, however, showed that these two functions were perceived as unavailable by the largest two student proportions whereby 44.4% did not have the opportunity of taking online quizzes and 39.4% did not have to create or update a Web Page. Results may have differed had they been made available on more course Web sites. Furthermore, these items were excluded from further analysis because they did not have high factor loadings.

5.4.1.3 Functions with medium range availability but high percentage of non-users

On this note of availability, several functions were *made available but were least used* by a larger proportion of students – in particular, viewing slides or pictures on the course Web site (Q4, 23.2%), viewing multi-media presentation/lecture notes (Q3, 17.6%), and communicating with content experts (Q10, 16.2%). Communicating with other students, via e-mail/listserv/hypermail/Chat rooms, etc. to discuss the ideas and concepts taught in the course (Q8) was used by only 38.7% of respondents. Interestingly, the data revealed that the function of communicating with course instructors and teaching

[9] Only missing value in all responses for Time Spent Category

assistants was perceived as available by 96.5% of students but had a relatively large percentage of non-users (43.7%), even though it ranked fourth in terms of high usage *by users*.

5.4.2 Student Reported Time on Task

All respondents were requested to report the amount of time each spent on a given function on the Web site in a typical week during the semester. Results pertaining to the INTERACT index are shown in Table 11 for each function.

Table 11

Descriptive Statistics of Amount of Time on Task in Hours on a Typical Week During the Semester in Rank Order by Mean Time Spent

INTERACT	n[10]	M = in mins[11]	SD
Q1. Searching the WWW to access reference materials and/or conduct research for the course.	133	1.06 = 64	1.07
Q2. Downloading/printing information from the course Web site.	137	0.68 = 41	0.75
Q3. Viewing a multi-media presentation/lecture notes on the course Web site.	116	0.63 = 38	0.90
Q5. Picking up or completing assignments on the course Web site.	127	0.57 = 34	0.67
Q8. Communicating with other students, via e-mail/listserv/hypermail/Chat, etc. to discuss the ideas and concepts taught in the course.	127	0.57 = 34	1.05
Q9. Communicating with the course instructor or teaching assistant(s), via e-mail, to make a suggestion/complain/ask questions about the course.	136	0.40 = 24	0.64
Q10. Communicating with content experts outside your college or University via e-mail, or through the course Web site via hypermail or Chat.	118	0.19 = 12	0.62
INTERACT Mean Index Score	142	0.45	0.48

These results exclude non-users from the calculations based on the understanding that the means reflect average time spent on a given function *by users* of that function. Including non-users underestimates the mean time spent by users.

[10] Calculations exclude respondents who stated function is NA therefore this does not reflect N=142
[11] Minutes rounded off

As Table 11 shows on average, the longest time spent as slightly over an hour (64 minutes) on searching the WWW to access reference materials and/or conduct research for the course (Q1). This was followed by downloading and/or printing information from the course Web site (Q2) that is approximately 41 minutes per week. On average per week, students spent at least 38 minutes viewing a multi-media presentation (Q3). They also spent approximately 34 minutes picking up and completing assignments (Q5) and communicating with other students via email, listserv, hypermail, or chat rooms, etc. to discuss the ideas and concepts taught in the course (Q8).

Interestingly, while this result is mostly consistent with functions with the highest percentages of usage reported above in section 5.4.1, there appears to be some distinction between items that have a large number of users and items that students spend more time on. For example, while more respondents e-mail their instructors and their teaching assistants than those who e-mail their peers to discuss supposedly "academic matters", the time spent on the latter function is much more. Similarly, while less than half the respondents view multimedia presentations and class lectures on the course Web site, those who do, spend a greater amount of time on this function compared to others.

By contrast, students spent little time communicating with content experts outside their college or University via e-mail or through the course Web site, through hypermail or chat rooms (Q10). This result is interpreted with caution given that most of the Web sites did not highlight this function to any great extent, and for several classes, they were not available on many of the course Web sites. The findings are consistent with the low number of respondents (n) and percentages of users reported in Table 10 and discussed earlier.

Table 11 also displays time spent on each function in rank order on the INTERACT index. The difference between the highest mean score (Q1) and the lowest mean score (Q10) shows a difference of 0.87, which, in practical terms, means almost one hour (52 minutes). In addition, the difference in mean scores between searching the WWW (Q1) and the second highest function of downloading and printing (Q2) is 0.38. This translates into a difference of slightly under a half-hour (23 minutes). So while students spend approximately 41 minutes on average downloading and printing information from the course Web site, they spend an additional 23 minutes conducting research that may be accessible via the WWW that may or may not be readily available on their course Web sites. This result may have implications for students' use of time in terms of setting priorities for studying and also for printing costs when using the WWW. Students, having constraints on their time, may weigh its usefulness in relation to other means of conducting research. It also has implications for a Syracuse University policy imposing a 500-page per year no charge quota limit placed in effect as of January 2000. This is further discussed in chapter six.

Students were also requested to indicate other functions they engaged in that were not included in the survey. Only 10% of the sample responded (n= 14). Results indicated that students spent more than 4 hours on average in a typical week on non-academic functions such as job hunting, searching for non-course related information and conversing with friends. They also reported functions already included in the survey such as obtaining their assignment/exam grades off the Web site, obtaining feedback, reading class announcements, doing practice problems and downloading assignments. Other functions reported included looking up syllabi, or looking for extra credit opportunities,

and so on. These answers were not included in the statistical computations and are only reported in this section.

It is worth noting that initially there appeared to be some inconsistency regarding how the communication function on the course Web site was used. Further analysis revealed that the purpose and type of communication is an important conceptually discriminating, factor. Results showed that, on academic related communications, there was a higher percentage of users communicating with instructors and teaching assistants (Q9, 24 mins.) than students amongst each other (Q8, 34 mins.). However, users spent more time communicating with each other than with instructors and teaching assistants. Meanwhile, the function of communicating with content experts outside their college or university was hardly used (Q10, 12 mins.).

In summary, it is possible to conclude from the above findings that course Web sites were most frequently used by students for research purposes. This research might have included conducting searches or accessing material already compiled on the course Web site. This was followed by other interactive functions with course Web site material such as downloading/printing information, viewing multi-media presentations and class notes, picking up and completing assignments. Students also engaged in various communication activities, communicating each other and also with their instructors and teaching assistants, but spending more time communicating with each other.

5.5 Question # 2

What was the quality of the course Web sites according to students?

This section presents and discusses findings regarding students' judgments of the instructional quality of their course Web sites. In order to judge quality, an *Instructional Quality* category (Questions 15-32) was developed in the student Web site perception survey (SWPS). The *Instructional Quality* dimension was represented by 18 items (Alpha = 0.90) that attempted to measure the presence of *Gagnés nine events* in a Web-based context using a 5-point Likert-type agreement scale (0-4, where 0=No Basis for Judgment/Not Applicable and 4=Strongly Agree). Respondents were provided with a *Not Applicable/No Basis for Judgment* option to address non-availability of any given function or element on their respective course Web sites and these responses were not included in mean computations for each function. The rationale is that what is of importance here is the perceived quality of these various functions therefore, respondents who did not have an opinion: did not make a judgment quality. Therefore, only responses from students who actually formed some opinion about the quality of the Web sites were included in mean computations. Two constructs were confirmed by factor analysis: APPEAL and PURPOSE and were used to create indexes for *Instructional Quality (Q)* (see section 3.6.2 for index construction). Table 12 and 4.5 respectively provide descriptive statistics for each item and index scores.

Table 12

Descriptive Statistics on Students' Level Agreement with the Quality of Instructional for APPEAL Index in Rank Order by Item Means [Scale 0-4 (4=Strongly Agree)]

APPEAL	n[12]	M	SD
a) Motivation and Web site Appeal (APPEAL)			
Q19. The Web site was easy to read.	131	3.16	0.62
Q15. The use of graphics, sounds, pictures, animations made the Web site material more appealing to you visually.	91	3.10	0.58
Q16. The combined use of text, graphics and/or sound to represent the information in different ways enabled you to better understand the material.	100	3.08	0.69
Q27. The introductions to Web segments were well-stated in terms of clarity and purpose	115	2.96	0.64
Q18. The colors used were in good taste and well coordinated	116	2.94	0.62
APPEAL Index Score	**132**	**2.37**	**0.37**

Results in Table 12 indicate that the highest rating of quality was the readability of the materials on the Web sites (Q19). This was closely followed by the use of appealing visual display (Q15). However, the lowest ratings were for the use of color in good taste (Q18). The introductions to Web segments were well-stated in terms of clarity and purpose (Q27). Perhaps better design of these features and functions may increase the time spent overall. The overall index score for APPEAL was slightly above average (M=2.37) and variation among groups was very small (SD=0.37).

[12] Calculations exclude respondents who stated function or characteristic is NA

Table 13

Descriptive Statistics on Students' Level Agreement with the Quality of Instructional for PURPOSE Index in Rank Order by Item Means [Scale 0-4 (4=Strongly Agree)]

PURPOSE	n[13]	M	SD
b) Clarity of Purpose, Objectives, and Organization			
Q20. The material on the Web site was important for class.	128	3.41	0.66
Q22. The specific tasks for every assignment were specifically stated.	124	3.12	0.77
Q25. New material to be learned was well organized on the Web site	93	3.02	0.71
Q23. For each new section of the Web site, its connection to the course objectives was made clear to you.	120	3.00	0.77
PURPOSE Index Score	**132**	**2.25**	**0.41**

Results in Table 13 indicate that the highest rating of quality was the importance of the materials on the Web sites (Q20). This was closely followed by the specific statement of the required tasks for every assignment (Q22). However, the lowest ratings were for the connection made between each new section on the Web site and the course objectives (Q23). The overall index score for PURPOSE was above average (M=2.25) and variation among groups was very small (SD=0.41) but slightly larger than that for APPEAL indicating lesser agreement among groups that the course Web sites clearly stated the purpose and objectives of their use. In sum, the course Web sites were generally judged to be important and purposeful. New material was well organized into sections. The connection made between these sections to the course objectives, while rated highly appear in need of some improvement in comparison to other functions.

5.6 Question # 3

How useful did students perceive their course Web sites?

This section presents and discusses findings regarding students' perceived usefulness of various functions of their course Web sites. In order to answer this question, a *Usefulness* dimension (Questions 33-47) was represented in SWPS using a 6-point Likert scale (NA, 0-4, where NA=Not Available/No Basis for Judgment and 4=Highly Useful). This category consisted of items that measured the extent to which students perceived certain functions as useful (Alpha=0.89). Respondents were provided with the option of stating that the function was *Not Available* on their course Web site or that there was *No Basis for Judgment.* The theoretical basis for these items was derived from Gagné's nine events of instruction. However it is important to note that while these functions are conceptually related to the functions included in the *Instructional Quality* category mentioned above, they are nonetheless different primarily in the context and wording of the questionnaire items and in the factors that were confirmed for this index when factor analysis was computed. Tables 14 and 15 below present results for two indexes created to represent *Usefulness*[14] on two constructs PREPARE and GUIDE (see section 3.6.2 for index construction).

Table 14 below provides means and standard deviations for all items. As can be seen from the results in Table 14, students reported that the use of pictures, tables, diagrams, etc. to recall or present new information was the most useful function of the

[13] Calculations exclude respondents who stated function or characteristic is NA
[14] ATTITUDE, a third construct of Usefulness is discussed later in response to research question # 4 in this study.

Web site (Q44). While all functions were perceived as useful as indicated by the lowest mean score (M=2.31, SD=1.03), the *least useful* function was providing links to review pre-requisite material to help recall (Q35).

Table 14

Descriptive Statistics of Students' Perception Of Usefulness for PREPARE Index in Rank Order by Mean [Scale = NA-0-4 (4=Highly Useful)]

PREPARE	n	M	SD
Q44. The use of pictures, tables, diagrams, etc. to recall or present new information.	78	2.79	1.00
Q46. Overall, I have found the course Web site.....	132	2.63	1.13
Q45. The additional links and information on the Web for further study.	96	2.43	1.16
Q35. The links to review/prerequisite material to help recall.	91	2.31	1.03
PREPARE Index Score	**132**	**1.87**	**0.74**

Overall, results in Table 14 show low mean index score for PREPARE (n=132, M=1.87, SD=0.74). These functions represent Gagné's events that state that students should be provided with the opportunity to recall prior learned knowledge to associate it with the new knowledge and also to be provided with the opportunity for further enrichment and remediation to facilitate transfer of this new knowledge. The capabilities of the WWW are to support visual display of information represented in the use of tables, diagrams, and other graphics. However, this low mean index score indicates that the Web sites need improvement particularly in the clarification of how the external Web site links relate to course objectives.

Table 15

Descriptive Statistics of Students' Perception Of Usefulness for GUIDE Index in Rank Order by Mean [Scale = NA-0-4 (4=Highly Useful)]

GUIDE	n[15]	M	SD
Q40. The opportunity to ask questions online (e-mail, listservs, hypermail, etc.).	112	2.74	1.00
Q41. Posting graded assignments/Home Work on the Web.	64	2.66	1.30
Q43. Online practice assignments (e.g. simulations, problems).	47	2.64	0.85
Q39. Online feedback on various assignments from Instructor/Tas.	73	2.60	1.00
Q42. Situations, case studies, formulas, problems, simulations, etc. posted on the course Web site to improve learning.	65	2.52	0.99
Q38. Online Self-Assessment Quizzes (where the answers are provided).	49	2.51	1.23
Q37. Instructions on how to navigate the Web site, download software, get an account, subscribe to a listserv.	100	2.30	1.10
GUIDE Index Score	**131**	**2.20**	**0.71**

Table 15 shows means and standard deviations on perceived usefulness of functions that pertain to the heart of the instruction as represented by Gagné's events which state that performance should be elicited, opportunities for practice should be provided, and students should receive feedback on their performance as further guidance. These events are represented by the items listed in Table 15. Results show an overall higher index mean score (n=131, M=2.20, SD=0.71) compared to the one reported in Table 14.

[15] Calculations exclude NA responses

Respondents found that the opportunity to ask questions online was the most useful function and the posting of feedback on graded assignments as the next most useful function. This is closely followed by online practice assignments. It is evident that students appreciate the prompt feedback capabilities of electronic communication that is further enhanced by the visual capabilities of the WWW. These results provide evidence of the importance of feedback to clarify students understanding of new knowledge through one to one e-mail or from instructor to group communications by e-mail or through visual display of model answers, or automated feedback.

In summary, all functions on the course Web sites are appreciated by students and perceived as useful, but to different extents. While, overall, students perceived their course Web sites as useful, there were large proportions of students who did not perceive most of these functions listed above as available. These large proportions of responses reveal a shortcoming in the optimal use of the WWW of equal importance to perceived usefulness. The above results point out various shortcomings in the current instructional design of these sampled Web sites and point to practical implications for optimal integration of the WWW to be discussed in chapter six.

5.7 Question # 4

What demographics and characteristics influenced students' use and perceptions of quality and usefulness of course Web sites?

As stated earlier in section 3.2, the purpose of this question was to explore possible influential factors on time spent on course Web sites and students' perceptions of their course Web sites. While question #5 summarizes narrative data, this question explores statistical relationships among the following respondent demographics and characteristics based on the following assumptions:

- **Residential Distance -** students living off campus outside the 1-5 mile walking distance range were expected to give lower ratings on the usefulness of the course Web site than their counterparts living within the 1-5 miles range. Similarly, SU South campus students were expected to rate the course Web sites less useful and spend less time on the Internet than their SU North Campus counterparts. The rationale for both expectations is that living at a distance may require more support of learning given the inconvenience of driving to campus to meet with instructors and teaching assistants. This is based on the narrative data where SU South Campus students reported that they had no access to the Internet from their campus dorms. Second, given the academically-related inconveniences associated with living farther away from campus, it was expected that there would be more reliance on the course Web sites. Since these Web sites were not designed to fully support a distance learner, it was expected that students would experience some frustration. Thus, a likelihood of a negative correlation between distance and usefulness and between proximity and usefulness was anticipated.

- **American and International Students** – International students were expected to spend more time on the course Web sites as indicated by the INTERACT index than their American counterparts, particularly since some international students might find it easier to communicate with their course instructors and teaching assistants than having face-to-face discussions which require more sophisticated verbal and non-verbal communication skills that differ from culture to culture.
- **Type of Internet Connection** - Two groups were compared on this characteristic, those who have an Ethernet connection and those who have dial-in only connections. Given that the dial-in only group might have been frustrated by slow connections, the students with Ethernet connections were expected to find the Web sites more useful since they could more easily log onto the Internet.
- **Modem Speeds** - Students with higher modem speeds were expected to spend more time on the course Web sites and to perceive them as more useful than their counterparts with slow modems, who might have been more easily frustrated by interruptions and busy line signals.
- **Years of Accessing the WWW** - Students with more years of accessing the WWW were expected to find the course Web site less useful than their counterparts since they might have been more capable of conducting their own research independent of what was made available through the course Web sites. Given that these Web sites were overall not very developed, it is likely that the more experienced students found these Web sites too basic for their more sophisticated expectations of the WWW.
- **Courses** - Differences were expected between courses and perceived Time Spent (T), Instructional Quality (Q), and Usefulness (U) given the variation in instructional

quality identified by WIDEC scores.

- **Skills and Attitude** – Students' level of Internet skills and attitudes toward the course Web sites were expected to influence perceptions of T, Q, and U. A strong positive correlation was expected between SKILLS and T, Q, and U and between ATTITUDE and T, Q, and U. The rationale was that students with higher Internet skills were expected to find the course Web sites less useful as they can manage on their own and would spend less time on the course Web sites. Similarly, students with a positive attitude toward the course Web site were expected to spend more time using it and find it more useful than those who do not like the course Web site.

In order to test these assumptions, an intercorrelation test was conducted for all demographics and characteristics including the indexes representing *Time Spent, Instructional Quality, and Usefulness*. Results are summarized in Table 16 below.

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Summary for only significant results of the exploratory analysis follows: Overall, the strength of the correlations was within the low to medium range. Examination of the stronger correlations reveals two types, ones that were expected to correlate given the context of the study and others that provided support for some of the above made assumptions. Stronger correlations overall were found between age and academic class (r=0.57), residential proximity and age (r=0.42) and residential proximity and class (r=0.64) where undergraduate students have traditionally lived on or very close to campus. A positive correlation was found between years of accessing the WWW and perceived Internet skills (r=0.29). There were no correlations found between sex, modem speed, and type of Internet connection and any of the study variables.

- **Residential Distance**

As expected, relatively strong correlations were found between residential distance in miles for off-campus students with students' perception of usefulness indexes (r = -0.27 for GUIDE and r = -0.39 for PREPARE). Apparently, the negative strong correlation may have implications for students' dependence on the course Web site the farther away they live from campus. These students may depend on the course Web site to obtain material and communicate with instructors and peers more than their counterparts and therefore they are probably more critical of the usefulness of the course Web site. Descriptive statistics showed that the farther the distance from campus, the lower the perceived usefulness on the PREPARE index. An ANOVA test of variation among means also confirmed variations among residential distance of off-campus students (n=65, F=2.35, $p<0.05$) again specific to the PREPARE index comprising of functions related to recall, enrichment, and remediation. The Tukey test did not explain

this significance in findings. No significance was found among SU North campus and South campus students contrary to above noted expectations based on contextual factors.

- **American and International Students**

Other interesting findings include a positive correlation between perceived Internet skills and the INTERACT index. Non-American students had more years of access to the WWW than their American counterparts as indicated by the negative correlation (-0.22) and more interaction on the Time Spent Index ($r = -0.18$) confirming the author's assumption that there would be differences found on this index, albeit a very low correlation.

- **Courses**

Results for ANOVA were significant for courses and students' judgments of quality particularly in relation to functions relating t the PURPOSE index ($df=8$, $F=4.33$, $p< 0.0001$). A Tukey test showed specific variations between means for the HST100 course and three other courses: BIO400, SPP500, and FOR300. These results are further explained by narrative data where students in the HST101 course reported that they were obtaining everything they needed in class and were not sure about the purpose of the course Web site overall. HST100 received the lowest mean score amongst the group on the PURPOSE index ($n=11$, $\underline{M}=1.8$, $\underline{SD}=0.50$). By contrast, the BIO400 course received the highest mean in the group on the PURPOSE index ($n=28$, $\underline{M}=2.50$, $\underline{SD}=0.31$). The narrative data indicated that the BIO400 course Web site was perceived as essential to class, as indicated by instructors' emphasis on use by making some material only available on the course Web site. The FOR300 ($n=21$, $\underline{M}=2.4$, $\underline{SD}=0.33$) and the SPP500 ($n=6$, $\underline{M}=2.5$, $\underline{SD}=0.35$) were also in a similar situation as the BIO400 as indicated by

statistics and also by student narratives. In addition, these courses had the highest mean scores among all nine courses. It appears that the course ranking on the WIDEC scale was not so consistent with students' perceptions of the quality of the course Web sites specific to the PURPOSE index. Specifically, HST100 which ranked high on WIDEC scale received the lowest mean scores respectively on the *Quality* index. It appears that students' judgment of quality, particularly in relation to the PURPOSE index, is influenced by required use and instructor support of the course Web sites. This is further discussed in chapter six.

- **Attitude**

Keeping in mind, the low reliability of the ATTITUDE index (Alpha=0.67), several strong positive correlations were found with PURPOSE (r=0.44), APPEAL(r=0.40), GUIDE (r=0.32) and PREPARE (r=0.52). Interestingly, this relatively high correlation between PURPOSE and ATTUTUDE further supports the above findings that students' judgment of quality may be influenced by students' general attitude toward the purpose and required use of the Web site. The more students' are encouraged to use the Web site and perceive it as useful, the more likely they highly judge the quality of the Web site.

- **Other Related Findings**

GPA correlated negatively with years of accessing the WWW (r=-0.28) and with residential proximity (r=-26) but positively with students' nationality, where international students had higher GPAs (r=0.33). A simple regression test revealed some variation but no linear correlation between motivation functions and Web site appeal (APPEAL) and student GPA (n=113, df=1, F=4.40, $p<0.05$, R-squared=0.04).

Intercorrelations among the indexes resulted in PREPARE strongly correlating with the other *Usefulness* indicator APPEAL (r=0.52) and also with one of the *Instructional Quality* indicators GUIDE (r=0.52). This may indicate, perhaps, that students' perception of the usefulness of functions that enabled them to prepare for class or to seek remediation and enrichment (PREPARE) are influenced, and vice versa, by their overall perception of the quality of the Web site functions that guide their learning (GUIDE).

In sum, this concludes the exploratory analysis for factors influencing students' perceptions of *Time Spent*, Web site *Usefulness*, and judgments of *Instructional Quality*. Results are not conclusive given the small sample size of the study, low correlations, and the lack of further detailed explanatory narrative data related to the above. Further research possibilities are suggested in chapter six.

5.8 Question # 5

What were some student reported barriers to and facilitators of use of the course Web sites and overall perceived impact of the WWW on students' learning experiences?

This section reports students' open-ended comments regarding their perceptions of their course Web sites that the closed items on the questionnaire might not have included. Interestingly, the comments seem to support the above findings and provide further explanation that is discussed in chapter six.

5.8.1 Students' Perceptions of Facilitators to Successful Use of the Course Web Site

Approximately 322 statements in total were provided by 138 respondents in response to Q12 in SWPS on the three greatest facilitators to successful use of the course Website. Overall, the three most helpful aspects provided by the course Web sites were

Guidance, Content, and Availability of Materials. While the results when computed in percentages did not provide very high figures (highest was only 9.4%), the following is a comparative analysis within those small percentages generated. Thus, in terms of frequency of reporting, *Guidance* and *Content* ranked as the two highest factors at 9.4% each. *Availability of Materials* ranked second at 9.1%. *Access* ranked third at 7.9%, and *Ease of Communication* ranked fourth at 7.2 %. Table 17 further illustrates this.

Table 17

Summary of Overall Most Helpful Factors for Total Sample*

Most Helpful	**Second Most Helpful**	**Third Most Helpful**	**Fourth Most Helpful**
Guidance 9.4%	Availability of Material 9.1 %	Access 7.9 %	Ease of Communication 7.2 %
Content 9.4 %			

Other	**%**
Web site Organization	6.9%
Remediation	5.7%
Currency of Announcements	4.7%
Orientation to Web site	3 %
Web site Design	2.9%
Enrichment and Professor Endorsement	2.5%
Motivation and WWW Features	1.9%
Speed and Ease of Use	1.6%
Navigation and Clarity of Information	1.3%
Time, Relevance of Information, and Printability of pages	0.9%
Convenience, Ease of Downloading, and Ease of Printing	0.6%
Appealing Web pages, Assessment, Class Assistance, Instructions Learning Style, Downloadability, Quality of Content, and Readability	0.3%

* Figures include rounding off error

Guidance included statements related to providing students with directions, detailed written instruction on how to use the Web site. It also entailed statements about

what to do or know and detailed explanations. Guidance was perceived online in the form of the syllabus, professor/TA assistance via email, providing objectives for each chapter, relevant links, and pictures. It also included use of the Web site during class time.

Content categorized statements that referred to the selection of Web sites that the faculty provided links to. It also included online presentation of course outlines, access to speaker notes, dictionary, and quantity and quality of information, hyperlinks to specific topics of relevance, slide files, links to research papers, and most of all class notes.

Availability of Material is very similar to *Access* but was more specific to accessibility of specific information and content that is needed for class. It also included posting assignments online, and the ability to retrieve material or work that was missed due to absence. Some students mentioned that, for example, when they missed a slide in class, they could always go back to the Web site for the complete collection. In addition to slides, class notes, and hand-outs were also perceived as readily available and made accessible by the Web site.

Access referred to statements about access to grades, having one's own computer, easy access to the Web site, the existence of a course Web site, and access to the site from any computer with a network connection.

Ease of Communication referred to ease of contact with TAs, professors, and other students. This was particularly true with being able to contact the professor at any time. The availability of a biographic page for the Immunbiology course, or TA and classmates' e-mail addresses, was appreciated. Use of forms to submit to the faculty, be

it weekly assignments, quizzes, or other was also considered helpful. This method of being able to send information to the faculty, such as various assignments was also considered a means of completing class responsibilities.

Finally, in addition to the above mentioned four most helpful factors, other issues emerged as also useful and helpful, including organization and design of course Web sites, remediation functions, and currency of announcements. Again, these issues seemed to emerge from across all nine courses in varying levels of importance as measured by percentage of occurrence.

5.8.2 Students' Perceptions of Barriers to Use of the Course Web Sites

Approximately 277 statements in total were provided by 140 respondents in response to Q13 in SWPS on the three greatest barriers to successful use of the course Web sites. Several factors emerged as barriers to use of the course Web site in response to Q13 in SWPS. Consistently throughout the data, very similar issues emerged as barriers in every course. This greatly facilitated the categorization of the data. Each category is described below and examples are provided. To begin with, Table 18 reports a summary of findings:

Table 18

Summary of Overall Barriers for Total Sample *

First Barrier	Second Barrier	Third Barrier	Fourth Barrier	Other Barriers	
Access	Lack of Skills	Motivation	Time	Organization	5%
				Design	5%
17%	16%	13%	12%	Relevance	4%
				Printing problems	4%
				Lack of Information	4%
				Connection	4%
				Computer Problems	4%
				Currency	4%
				Content	3%
				Speed	3%
				Downloading	2%
				Network	1%
				Readability	1%

* Figures include rounding off error

Access ranked as the highest perceived barrier across all groups (17%). Previously reported descriptive statistics showed 97.9 % access rate which was brought down by the fact that only 71% of the Phonation Disorders class had access. Access in the survey was defined as owning a computer or having regular access to one. However, in the open-ended question, respondents defined "access" to include waiting in line at campus computer clusters, and room-mates who did not always want to share their computers. Accessing certain links was included in this category.

Lack of Skills closely ranked as the second perceived barrier across all groups (16%). Many students attributed their dissatisfaction to low self-ratings of computer literacy. Many reported that only by overcoming initial barriers, such as knowing how

to navigate a site, downloading, and staying focused, were they finally able to enjoy the experience and make use of it.

Motivation, followed closely by *Time* ranked as the third and fourth barriers (13% and 12%) respectively. Many students reported that the desire to access the Web site was crucial; particularly when it was not obligatory or required by many of their instructors. This was particularly true for courses where the instructor did not provide any encouragement or make any demands on their students to use the Web site. Time was also perceived a barrier considering the trouble some students reported that they had to go through in order to access the site. Other related barriers that were mentioned included the time they spent waiting in lines at computer clusters, problem links of the Web sites that prevent them from accessing the references they desired, printing and downloading problems. Having access to this material through other means and the instructional worth of the content they have to access were two issues students reported to impact their perceived sense of time allocated for Web use.

5.8.3 Impact of Course Web sites on Students' Learning Experiences

This section provides a summary of the findings of the content analysis performed on the open-ended question regarding students' perceived impact of the course Web sites, if any, on their learning experiences. The third open-ended question in SWPS (Q14) elicited students' perception of the impact of the WWW on their learning experience. Overall, responses were highly favorable concerning the use of the technology with only some minor unfavorable comments and some indifference.

Students reported that there were several advantages and a few disadvantages in using the course Web site and they are as follows:

- time-saving
- facilitated preparation for class
- increased understanding of class expectations, objectives, and facilitated learning
- kept students "tuned in" to what was going on in class
- provided enrichment in terms of content and access to a wide variety of resources
- provided 24-hour access to content, faculty, teaching assistants, and class-mates
- served as an easy and convenient communication tool
- value-added
- paper wasting

These findings are further discussed in chapter six in combination with findings from the above questions.

- **Time-saving**

Further elaboration of the above reveals that the time-saving function of the Web site meant that the course Web site made a difference in terms of lessening class time allocated to detailed note-taking, presentations, and slides and conducting research. The Immunobiology class, for example reported that posting class notes and slides increased their level of concentration in class by allowing them to pay more attention to concepts. It also allowed for more time to review the lecture-notes and to stay "in touch" with the material especially since they reported that there were many pictures that they had to recall and comment on. Similarly, the Phonation Disorders class reported that time was saved on note taking and on searching for readings. One student said, "I would fail because all my time would be spent looking up articles in books". Similarly the students in the Physics class reported saving time on photocopying in the library.

- **Facilitated preparation for class**

Students from the Soils class, for example, reported that the course Web site contained supplementary material that was not accessible from any other resource. They therefore believed that they would have been behind in lab materials without the Web. Meanwhile, the Physics class reported better access to content and instructional functions such as problem sets, answers to certain problems, and being able to review assignments or prepare for exams through the Web site. The Freshman Writing class reported that they were able to do their homework assignments on time and as scheduled because they were reminded of them through their course Web site. The Physics class also reported a similar situation. The Immunobiology class reported that the Web site further facilitated recall of graphs and diagrams and various domains of information.

- **Increased understanding of class expectations, objectives, and facilitated learning**

The Web site became a source of " knowing what to expect ", "knowing where to check up specific content " and knowing " what's going on in class ". Students from Immunobiology class for example, commented on the well-organized format of their course Web site that included class notes. Students reported that they were well laid out and easy to print and easier to study from because they know exactly what was taught. Others added that they could understand more of the concepts after viewing the information before class. In fact, knowing what to expect each day when going to class was considered another value-added feature. The Physics class for example, also commented on being better able to understand many of the problem sets due to receiving online help and studying tips for the exam. They added that solutions provided to homework assignments on the Web site were also considered helpful in studying for

exams. Consequently, some believed that the Web site had helped performance on tests and made the material more understandable. Similarly, providing quizzes ahead of time was also appreciated. The Immunobiology students reported that they found being able to prepare for the quiz ahead of time was most useful. In fact, one person reported that the availability of quizzes on the Web site was "the one thing that had made some impact on my educational experience if nothing else". Above all, some stated that easy access to old exams and material created a positive perception of studying. Printing out relevant exams at the time of need was perceived to facilitate studying.

- **Kept students "tuned in" to what was going on in class**

Many students appreciated easy access to announcements, updates on scheduled events and, above all, keeping abreast of what was going on in class when they had to miss class. The Immunobiology class, for example, perceived the Web site a good communication tool to obtaining information during absence or when there was a need to send assignments or messages over the Internet during vacations. Similarly, the Freshmen Writing students reported that the course Web site also updated absent students on class functions and therefore enabled them to keep up with class pace, while the Writing Studio class appreciated access to class assignments and updates on the syllabus and reported that scheduled events were easier to find out. In addition, students from the Immunbiology class considered the Web site a good source of information update that "lessens the need to have to get everything directly from the professor".

- **Provided enrichment in terms of content and access to a wide variety of resources**

The Web site also proved useful in that the students in Soils class reported having access to content-related information resources such as the "NRCS official Soils series". Others reported constant use of the Internet to gather information for various reasons – educationally and socially. Some felt that they their educational experience has become better with its integration into their learning experiences. For example, some students explained how less laborious background information research has become. Not having access to the course Web site has a negative impact on research-focused courses because they are restricted to a narrower variety of resources.

- **Provided 24-hour access to content, faculty, Teaching Assistants, and class-mates**

Convenient access to material was reported by many, as one of the positive aspects about the course Web site. The Immunobiology students in particular, reported that they did not need to go to the library to get quizzes on reserve. In addition, picking up and dropping off assignments was made easier through online uploading and downloading. Access to material and to the syllabus when away from home was also a positive experience reported. This access facilitated completion of homework assignments that normally would have been difficult to obtain or turn in during absence. Students who attend lab session such as the Soils class added that another advantage of easy access to lab material is being able to print them out a few minutes before the lab. This is much more convenient than receiving them in class and holding on to them until the next lab session which is typically held once a week while the class is held three times a week.

- **Served as an easy and convenient communication tool**

Others perceived access to the professor as another form of convenience and facilitation that prior to the Internet, they did not take advantage of. Some students reported that they typically had little or no interaction with professors because they do not visit during office hours. Online communication with the instructor was mentioned several times in terms of having easy access to the professor to ask questions and converse rather than having to "track him/her down".

- **Value-added**

In sum, many students considered the Web site as a convenient means of having access to content and therefore did not need to meet face-to-face with the TA as much, take detailed notes in class, or go to the library every day. Communication, a strong function of the Internet, served to increase the feeling of "connectedness with the professor" especially when the Economics class students explained that they had to give feedback about the course once a week. Greater access to not only assignments but also to people and realizing the potential of electronic educational aids was a value-added in addition to conducting research, as reported by the Freshman Writing class. Another beneficial "side-effect" was reported by the Soils class mentioning that the course Web site facilitated easier use of the Web in other subjects, a value-added increase in knowledge and skills in using the Internet. They also reported that using the course Web site made the course much less time consuming in terms of logistics and preparation time.

In terms of negative impact, students reported that printing documents was a waste of much paper. Some students reported using over 500 papers in one semester. This has implications for the 500-page quota limit imposed in Jan 2000 mentioned

earlier. Another negative impact reported is the possible loss of valued teaching styles such as lecturing and face-to-face communication. Several students reported no impact whatsoever because it was only one alternative resource amongst several and therefore there was no total reliance on the course Web site so its impact was hardly felt or conceptualized. In conclusion, the above findings have implications for instructional design theory and practice and motivational theory and adoption of innovations theory, in particular. These findings would be discussed in chapter six using these theoretical frameworks to ground the study findings.

5.9 Chapter Summary

This chapter has delineated the results of the study based on a survey of 142 students enrolled in nine course that use a course Web site as an instructional support resource to classroom based teaching. The chapter presented results of selected course Web site functions pertaining to three main indexes: *Time Spent* (T), *Instructional Quality* (Q), and *Usefulness* (U). In addition narrative data were categorized into various themes related to barriers to and facilitators of use and overall impact of the WWW on students' learning experiences. Results overall are favorable of WWW use particularly for functions that guide, motivate, prepare, and provide a purpose for students to use the course Web site. Students spent most of the time interacting with material and with instructors. However, the quality of interaction with materials could be more efficient and productive and interaction with experts could be increased. Summary of findings follows in chapter six.

CHAPTER SIX

Discussion

6.1 Introduction

The study sought answers to the following questions: (1) How did students allocate their time using their course Web sites? (2) What was the quality of the course Web sites according to students? (3) How did students perceive the usefulness of their course Web sites? (4) What demographics and characteristics influenced students' use and perceptions of quality and usefulness of course Web sites? (5) What were some student reported barriers to and facilitators of use of the course Web sites and overall impact of the WWW on students' learning experiences?

The purpose of this chapter is to discuss the findings of the study in light of relevant research findings and literature on optimal use of the WWW to *support* teaching and learning practices. The discussion focuses on methodological, theoretical, and practical implications relevant to the study. This chapter is organized around the following sections:

- Summary of Findings
- Theoretical Implications of Findings
- Practical Implications of Findings on Teaching and Learning Practices
- Methodological Implications
- Future Research
- Conclusions and Recommendations

A synthesis of findings is presented using a thematic organizational framework for discussion. The primary intended audience for this discussion is higher education faculty, students, administrators and instructional designers interested in improving teaching and learning practices by facilitating and supporting the integration of WWW technologies to support educational and training practices.

6.2 Summary of Findings

Study findings indicated an overall positive perception of the quality and usefulness of the course Web sites. In terms of time spent on given functions, on average per typical semester week, 64 minutes was spent on conducting searches on the WWW, 40 minutes on downloading and printing material, and 34 minutes on communicating with faculty and teaching assistants. The highest ratings of instructional quality were on the visual appeal and readability of Web sites and the importance of the material on the Web site. The lowest ratings of instructional quality were on the clarity and purposeful introductions to each segment on the Web site, the clarity of the connection of each new section on the Web site with course objectives, and the general taste in color of pages. The highest ratings for perceived usefulness were on the use of visuals to recall or present new information and the opportunity to ask questions online. The lowest ratings were the use of links to review/recall prerequisite material and instruction on how to navigate the Web site.

Students reported that the greatest barriers to use were access to computers and to Web site addresses (URLs), perceived inadequacy of their Internet skills, motivation to use the course Web site, and time constraints. The greatest facilitators of use were guidance, quality of content, availability of material, access to material, faculty, peers,

teaching assistants, and experts, and ease of communication. Overall impact of course Web site was its time saving qualities, 24-hour accessibility to resources, facilitating preparation for class, and increased understanding of class expectations and objectives. Finally, a negative relationship was found between residential distance from campus and perceived usefulness of course Web sites and a possible relationship between courses and students' perceived instructional quality specifically on functions related to clarity of purpose and objectives. In addition, there appears to be a general lack of motivation to use the course Web sites, possibly due to their lack of mandatory use and what students reported as a lack of incentive to use them for specific course requirements. Table 19 provides a summary table of findings.

Table 19

Summary Table of Findings

Dimension	**INDEX/Function**	
Time Spent	**Usage**	**INTERACT**
Highest /Most	Searching the WWW access reference materials and/or to conduct research for the course	Searching the WWW access reference materials and/or to conduct research for the course
Lowest/Least	Communicating with other content experts Taking an online Quiz Creating a Web page	Communicating with peers to discuss academically related matters
Instructional Quality	**APPEAL**	**PURPOSE**
Highest Quality	Easy to read Web site Appealing visuals	Importance of material on Web site
Lowest Quality	Clear and purposeful introductions to each segment Taste in color coordination	Clarity of objectives for each new section of the Web site
Usefulness	**PREPARE**	**GUIDE**
Most Useful	Use of visuals to recall or present new information	Opportunity to ask questions online
Least Useful	links to review/recall prerequisite material	Instruction on how to navigate the Web site, download software, get an account, subscribe to a listserv.
Influential Factors	**Demographics**	**Characteristics**
	Non-American students had more years of WWW access Non-American students spent more time on the WWW (low correlation)	The farther the residential distance the lower perceived usefulness There was a relationship between course and perceived quality (PURPOSE) Strong correlation between students' attitude and perceptions of quality and usefulness (PREPARE)
Satisfaction	**Greatest Barriers to Use**	**Greatest Facilitators to Use**
	Access to computers and Web site links Lack of Skill Motivation Time Constraints	Guidance Availability of Material Access to material and people Ease of Communication
	Impact of WWW	
	Time-saving Facilitated preparation for class Increased understanding of class expectations and objectives Kept students "tuned in" to what is going on in class Provided enrichment in terms of content and access to a wide variety of resources Provided 24-hour access to faculty, Teaching Assistants, and class-mates Served as an easy and convenient communication tool Value-added Paper wasting	

6.3 Theoretical Implications of Findings

This section discusses the findings using the most applicable to findings from the seven principles of good teaching and learning practices (Chickering & Ehrmann, 1996) and the nine events of instruction (Gagné, Briggs, & Wager, 1992) as the theoretical framework for the discussion. Other theories and supporting discussions are drawn upon from related literature.

6.3.1 Students' Perceptions of Web site Use

6.3.1.1 Good practice emphasizes time on task

Findings on technology use are consistent with Chickering and Ehrmann's (1996) principle stated in the subheading of this section. On average, students spent approximately 64 minutes of a typical semester week searching the WWW to conduct research. This function is where students spent most of their time. Given this finding, two interpretations are considered here: the time spent searching the WWW may have been spent productively, or time was spent unproductively. Evidence to support the latter contention can be found in the narrative data, where *Time* and *Lack of Skills* emerged as two of the three main barriers to the use of the Web sites for all students. Time constraints were reported as not having enough time to "sit down and do it". Students complained about slow modems that take them longer time to download pictures and graphs. Others mentioned that some sites took too long to be displayed.

Across all disciplines, students reported that they do not have certain skills. For example, the Freshmen Writing class reported: lack of familiarity with the WWW, not knowing how to navigate the Web site, and difficulties in retrieving information from the Web site. Students in the Soils class reported that the searchs were too broad and

that they were trying to figure out how search engines really worked or how to bookmark a site. Some students reported that they didn't know how to join a listserv. Students in the Immunobiology course reported that they did not have the skills to download information or "a great understanding with [of] computers". Students in the Economics class reported that they had trouble with the "graph tune up" program and did not know how to use it well. In sum, in every class, many students reported not having adequate skills that would allow them to use the course Web sites more efficiently. Finally, to compound the problem, many students reported that they had difficulty finding the course Web site!

Of concern here to the instructional designer and perhaps the course instructor is optimizing the use of the medium to make efficient use of time and orienting students on using the course Web site. Also, the designer or instructor should give attention to designing user-friendly Web sites that do not require students to download software, but are rather facilitative and supportive of their cognitive learning and information processing strategies. This could reduce the time spent on downloading software and printing text and pictures by increasing time spent on active engagement with the Web site. For example, El-Tigi and Branch (1997) suggested utilization of three popular Web design features – frames, tables, and maps – to organize Web sites to facilitate cognitive learning strategies described by West, Farmer, and Wolf (1994), in a Web-based context. These features could become organizational techniques that represent conceptual associations, optimizing information presentation to better represent the cognitive strategies discussed by West et al. (1994). For instance, frames utilize the technological capability of multiple screens, the user can scroll through one screen

while making associations with another. Image maps can be placed in strategic locations and can serve as navigational aids to the student. Tables can provide organizational structures that save on printing and downloading pages of text. Tables also may enhance learning by facilitating conceptual associations through their multi-dimensionality using vertical and horizontal associations between cells and also through hyperlinking. Should students need to print material, it is limited to a few pages of synthesized information.

6.3.1.2 Good practice develops reciprocity and cooperation among students

The second important finding is that there is a clear indication that students spent a lot of time communicating with each other through email. While students were surveyed regarding communications specific to discussions of academic-related matters, they may also have used email simply to socialize. No further information is provided by the data on this matter. Assuming that students do communicate about the course, then these findings provide empirical evidence for Chickering and Ehrmann's (1996) principle previously stated as a subheading. Students learn through discussions, reflective writing, and making meaning out of what they are learning by relating it to previously acquired knowledge and skills. This learning experience can be facilitated and enhanced through e-mail communications (Anderson & Lee, 1995; Tao & Reinking, 1996). The WWW, in this instance, serves as both a communication tool and as a search tool that brings a large information database to the students' fingertips.

In the narrative data, *Ease of Communication* was one of the three most helpful functions of the Web sites. Using forms to submit to the faculty, be they weekly assignments or quizzes, were also considered helpful. Having an email link on the course

Web site to faculty, teaching assistants, and even peers was considered an easy way to "get in touch" regarding course-related matters. A good example of this is the Immunobiology course Web site which had a student biography page that linked to their pictures, emails, and special interests – a feature that students reported facilitated communication.

It is evident that the course Web site provided easy access to email addresses of faculty, teaching assistant and peers. A review of the literature on the effects of e-mail communications in various contexts showed overall positive impact. In a study conducted by Anderson and Lee (1995), use of e-mail in a reading education class showed that e-mail played a major role in building a sense of community, facilitated the sharing of ideas and resources, encouraged risk taking, helped students reflect on their learning, and encouraged cooperative learning. E-mail communications have also been found to give students a better sense of audience (Schwartz, 1990). In addition, increased student and instructor interaction patterns were reported (Dreher, 1984). In their review of research about email in education, Tao and Reinking (1996) cited favorable findings from several studies that took advantage of some features of email communication. For example, overcoming temporal and spatial distances (Schwartz, 1990); and using email's relative anonymity and asynchronous features to encourage students to speak out (Fey, 1994; Anderson & Lee, 1995). The above explains the correlation found between international students and time on task on the interactive and communication functions. However, the negative aspects of email are also important to consider, but are not as relevant to this discussion.

6.3.2 Students' Perceptions of the Instructional Quality and Usefulness of Web site Functions

Key findings from the study are indicated below using the most relevant of Chickering and Ehrmann's (1996) seven principles of good teaching and learning practices for undergraduate education as the framework for discussion in combination with Gagné's nine events of instruction. In addition, relevant findings from the study serve to add to the limited empirical evidence regarding the relative merits of media selection models as pointed out by Reiser and Gagné (1983) in their review and evaluation of the learning effectiveness of the major features found in media selection models. The findings also serve to contribute to the empirical evidence for appropriate use of the Web as an instructional medium. Because the initial events of a lesson are often designed to re-arouse motivational states in the learner, the discussion will emphasize the importance and relevance of motivation theories to the application of Web design. Keller's ARCS model and its application in a Web-based context will be an integral component of the discussion of the nine events.

6.3.2.1 Good practice encourages contacts between students and faculty

An important finding was students' perceptions of the usefulness of communicating online. Electronic mail, computer conferencing, and the WWW have increased opportunities for students and faculty to interact and communicate much more efficiently than before. According to Chickering and Ehrmann, 1996, the nature of communication becomes more thoughtful, deliberate, convenient and safe. Moreover, the negative aspects of face-to face confrontation are lessened. This may be particularly relevant to international students.

6.3.2.2 Gaining Attention - Motivation[16]

Key findings from the study indicated that motivation in general is an issue that has emerged as important to this study's findings. The *Gaining Attention* component of the nine events is very limited in its presentation of motivational elements and therefore the ARCS motivational design model (Keller, 1983, 1987a, 1987b, 1987c, 1988) is used here to frame and guide the discussion. The ARCS model has four general requirements that must be met in order to motivate people to learn: (a) Attention, (b) Relevance, (c) Confidence, and (d) Satisfaction. Attention is a prerequisite for learning. It directs a learner to the appropriate stimuli. Relevance is connecting instruction to important needs and motives. Confidence influences a learner's persistence and accomplishment. Satisfaction entails natural and positive consequences and a sense of equity that are necessary elements to make learners feel good about learning results, so they will be motivated to learn. (Keller, 1987c, 1988). According to Keller (1983), one consequence of motivation is "to contribute to better learning" (p.388) and hence the quality of instruction. Another consequence is "the intensity of performance at a task" (p.388).

Key findings in the study identified a general lack of motivation to use the course Web sites. Specifically, motivational barriers were reported by the History, Economics, Public Affairs, and Physics classes. For example, in the Physics class, students reported that they did not have the desire to check the Web site. The Freshmen Writing course reported that the site had a complex URL address. They also reported that their instructor did not mention it very often so they developed a general lack of interest in the Web site,

[16] One of the nine events " Stimulate recall of prior learning " is not separately discussed due to insufficient data.

perceiving there was no need to use it. Some did not like to read from the computer screen, as well.

The History class reported that the URL address was also difficult to remember, and that they generally forgot about the existence of the Web site, especially since there was no explicit incentive to use it. Students from the Economics class reported that they did not have a need to use it, and that they had difficult remembering the address even when they had to submit a weekly online report. Likewise, both the Public Affairs and Writing Studio classes reported a general lack of incentive to use the course Web sites. It is important to point out that these findings were not surprising given that data from the faculty survey emphasized that instructors did not require mandatory use of the course Web sites for fear of some students not having regular access but the instructors did encourage its use. Nonetheless, besides teacher encouragement and mandatory use, course Web sites *can be designed* to be motivating. A discussion of the application of Keller's ARCS model to a Web-based context seems appropriate at this point.

Using a Web-based context, Small (1997), drawing upon Keller's ARCS model as a theoretical foundation, identified and empirically validated four general categories of a motivational Web site: engaging, meaningful, organized, and enjoyable. Students' attention may be gained by initial engagement, and this engagement is maintained by varying the look of activities at the site. Moreover, inquiry arousal sustains attention. This can be achieved by creating a problem situation that can be resolved by knowledge-seeking behavior. Problem solving warm–up activities using questioning techniques can stimulate curiosity and exploratory behavior.

In a Web-based environment, Small (1997) recommended that initial engagement must occur at the Web site starting point: the home page. She suggested the use of "eye-catching visuals, attractive screen layout, and humor... ..[as]... strategies that can grab the users' interest and arouse his/her curiosity" (p. 7). Relevant to this discussion is an interesting finding from this study. Students ranked visual appeal as a mark of high course Web site quality. A good example of some of these strategies was found on the Immunbiology course Web site where students were invited to submit a paragraph about themselves and a digitized picture was taken of them and posted on the Web site. Students reported their appreciation of this in their narratives, indicating that in a class of 89 students, getting to know each other through the course Web site was a great feature. Another example was provided by the History course where students could access a page containing photographs of a number of famous historical figures that they were asked to identify. Once they clicked on the picture, biographical data of the figure was provided. While the above is very feasible in a Web-based environment, the multi-media capabilities of the medium can further support such efforts through use of visual displays that engage students in mystery solving, offering answers through further exploration. In sum, Small (1997) recommended that relevance of a site must be established at the moment of access by providing a meaningful context to users by stating the purpose and importance of the Web site. This recommendation is supported by findings from this study where stating objectives also ranked highest in terms of quality of students' perceptions of Web sites, which is discussed next.

6.3.2.3 Informing the Learner of Objectives

Key findings from the study indicated that for all events of instruction, the level of agreement regarding the quality of instruction delivered via the course Web sites was highest in terms of *clearly stating objectives*. Students' highest ranking of quality, on one measure, was that the Web sites were easy to read, thereby adhering to a fundamental condition in presenting objectives. Another important finding is that the links to other sites were clearly related to course objectives and students highly rated experiencing no difficulty in following through links and making associations with original course objectives. The Web site objectives/purposes/expectations were stated in relation to overall course goals and objectives. A good example of this was found on both the Economics and the Soils class Web sites where course objectives were clearly stated in relation to the purpose of each major section on the course Web site. The Economics course Web site in particular clearly stated course objectives for every major section of the Web site. Students also appreciated this function in the narrative data. The findings support those of Schlopugh and Bhuripanyo (1998) reported earlier in section 2.5.2.3 where the clarity and importance of online documents in relation to course content increased the sense of connection with the course – considered a strength of the course Web site.

The importance of stating purposes and objectives as reported by findings is particularly interesting since the hyperlinking feature of the Web has been known to lead to information overload and a sense of disorientation and loss of control, and cognitive overload as the two most commonly identified problems in navigating through

hypermedia (Jonassen & Grabinger, 1989; Park, 1991). This state of disorientation was described as follows:

> Many hypermedia systems consist of hundreds of nodes with a potentially confusing array of links connecting them. It is well documented that in such systems, users can easily become lost, not knowing where they came from, where they should go, or even how to exit the program they are in. Users are frustrated by this experience, frequently losing sight of their *original purpose* [italics added] in using the hypermedia. Often they give up without acquiring any information from the hypermedia. (Jonassen & Grabinger, 1989, p. 15)

It is possible to predict that future research may find that overt and clear statement of objectives may not only play a large role in reducing students sense of loss and disorientation while navigating the Web, but actually may take on a very important role as a *motivator* for students to explore the Web as a *guide-on-the-side.* Hence, clearly stating objectives may have also increased students' perceptions of the importance of the Web site. Both the statistical and the narrative analysis of the data identified *the importance* of a course Web site as a mark of quality on one indicator. The data also identified a need for specifying purposes and objectives for each section of the Web site so students have clarity in terms of expectations and how to go about navigating the site to accomplish a task at hand. A related finding that provides support to informing students of objectives and purposes of Web sites is *Guidance*. This is discussed in later on in section 6.3.2.5.

Furthermore, setting educational goals, objectives, and purposes has been widely acknowledged in education research, particularly Bloom's taxonomy of objectives (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), which categorized objectives into a hierarchy of six classes (knowledge, comprehension, application, analysis, synthesis, and evaluation). The purpose of clearly stated objectives is to clearly define students' understanding (Bloom et al., 1956) and thereby establish a relatively specific expectancy concerning the outcome of learning (Gagné, 1975). When students are informed of what they will engage in during their learning session, be it online or in class, and what they will be able to accomplish upon its termination, this facilitates in directing students' attention to material that will enable them to attain the specified expectancies. In an open environment such as the WWW, this might be crucial to identifying the scope and focus of each learning session so as to: (a) make better use of students time; (b) facilitate navigation, and (c) direct students attention to what is really important and relevant. So that while they "freely" explore the WWW, they are able to make better choices on navigation, on what to download and print, and on which cognitive strategies they need to draw upon to accomplish their tasks and purposes.

Conceptually, it can be argued that there is a logical link between knowledge of objectives and perceived importance of a Web site leading to an increase in perceived relevance of the instructional functions on the Web site. Relevance of the task-at-hand to purposes, which is a necessary motivational requirement presented above in the ARCS model, is also central to creating meaningful Web-based learning environments. Relevance was identified as a 'central concept' to information science, a fundamental criterion for evaluating the effectiveness of information retrieval (Schamber, 1994 as

cited in Small, 1997). In sum, in a Web-based learning environment, given the inherent disorientation problems of the medium, overt and clear statements of expectations are crucial in serving not only as conceptual *navigational aids* but also as *motivational aids* and *virtual guides* for further student explorations of the WWW.

6.3.2.4 Presenting the Stimulus Materials

This event, Bretz (1971 as cited in Reiser & Gagné, 1982) contended, is best delivered by a medium other than the classroom instructor. His rationale is that the instructor's time can be better spent on tasks requiring "a greater degree of human judgment and personal interaction, such as may be involved in diagnosing learner problems" (p. 508). Findings from this study support Bertz' (1971) contention in that students reported that having class notes posted on the course Web site freed them from the burden of note-taking during class time and allowed them to focus on interacting with the instructor at a higher level of conceptualization.

Reiser and Gagné (1982) suggested that instructional stimuli should be similar to the stimuli involved in the performance to be learned. For example, when a learning task requires that visual features be distinguished, then visual media such as animation, graphics, and pictures should be employed. Similarly, auditory features should be used to present auditory stimuli. In this study, narrative data provided empirical evidence for students' great appreciation for the various multimedia capabilities employed to present information. For example, they appreciated the inclusion of slides and pictures for courses in which they were required to study hundreds of slides and pictures, as the case with the Soils and Immunobiology courses. In addition, narrative data also provided insights into students' appreciation of the auditory representation of various sounds in the

Phonation Disorders class. Both the visual and auditory stimuli were made available online to students through their respective course Web sites. Thus, students reported they were able to practice numerous times through this medium what would not have been possible or as valuable in one lab session. Students noted that this also allowed them to make better use of their classroom interactions with the faculty knowing that the slides were available outside of class on a 24-hour basis.

6.3.2.5 Providing Learner Guidance

Reiser and Gagné (1982) indicated that visual media is particularly useful for providing learner guidance. In particular, such media can "influence the semantic encoding process by helping learners establish mental images, which in turn are capable of enhancing retention (Gagné & White, 1978, p.508). The findings in this study also support this statement in that students had high expectations for the site in providing support and guidance. Evidence for this is found in the results where the most useful function on one indicator on the *Usefulness* dimension was the use of visuals to recall or present new information. As stated earlier, students appreciated *Guidance*. In this case, students expressed a need for more guidance to be incorporated in the design of the course Web sites.

Guidance emerged in the narrative data as the most helpful factor in using the course Web sites. As stated earlier in chapter five, *Guidance* was described by students as providing directions, statements about what to do or know and detailed explanations. *Guidance* was also perceived online in the form of the syllabus, TA/Professor assistance via email, providing objectives for each chapter, relevant links, and pictures. It also included use of the Web site during class time as a means of integrating the information

on the Web site and giving it importance. For example, students in the Economics course appreciated this function by stating that clear written instructions on the course Web site and pages with important links were provided. The Immunobiology students informed us that the detailed explanations, descriptions, and instruction on the course Web site were appreciated guidance. The Public Affairs students appreciated the helpful guidelines and the links to relevant information. The Soils class referred to *Guidance* as knowing what and when to access specific information for studying pictures necessary to prepare for the weekly lab class. The Phonation Disorders class appreciated receiving guidance on the lab material. All classes considered having the course syllabus online important, as well.

6.3.2.6 Eliciting Performance

Eliciting performance is discussed in many media selection models (Gagné & Briggs, 1979; Gropper, 1976; Romiszowski, 1974; Tosti & Ball, 1969, as cited in Reiser & Gagné, 1982). Several of these models indicated that responses required of students should be categorized by type (e.g. overt, motor, verbal). Media are then selected according to how best they are able to elicit these particular type of responses. A limitation of this study is the minimal data available on the event dealing with eliciting responses from students. Results of the Web site course analysis performed by the author showed minimal use of this event in many of the course Web sites sampled. Further research in this area may lead to more insights.

6.3.2.6 Providing Feedback

According to Reiser and Gagné (1982), there are several perspectives regarding media selection for this event. One view suggests that any medium is appropriate (Bretz,

1971) because any medium can provide knowledge of results. Another view indicates that the media used to provide feedback should depend on the type of learning outcome expected (Reiser & Gagné, 1982). For example, when learners are attempting to acquire intellectual skills it is desirable to provide them with correct and precise feedback. According to the authors, this type of feedback is well accommodated by interactive media such as computers. While a third view proposes that learner characteristics be considered when presenting feedback (Gropper, 1976). For example, error-prone learners may benefit from media that provide remedial branches. Findings from the study indicate that students greatly appreciated feedback on their problem sets and self-assessment quizzes provided online. Functions related to receiving feedback ranked highest on one of the *Usefulness* indicators presented in chapter five. More explicitly, it was the opportunity to ask questions, access graded assignments and homework answers, and receive online feedback on the above that ranked as most useful on the list of functions. These findings are worth comparing to findings from a study conducted by Hara and Kling (2000) who identified student frustrations regarding pedagogical issues, including uncertainty of instructor expectations, lack of prompt feedback, minimal feedback, and ambiguity of instructions on the Web.

6.3.2.7 Assessing Performance

In this study, online assessment was the weakest feature on all Web sites, perhaps due to the technical complexity, privacy, and security issues pertaining to posting tests online for public access. Therefore online assessment, did not have high factor loadings and had to be excluded from subsequent analysis. Nonetheless, because there were some examples of online practice quizzes and postings of old exams and answers online,

students were asked to comment on the usefulness of this event. Prior to its exclusion from the index, descriptive statistics showed that online self-assessment quizzes where the answers are provided were considered useful by students and ranked above average and considered more useful than (a) additional links; (b) online feedback from instructor; (c) using email to reflect on course work; and d) receiving instructions on how to navigate the Web site. Further research on the optimal use of the WWW to support assessment strategies is necessary.

6.3.2.8 Enhancing Retention and Transfer

Reiser and Gagné (1982) stated that visual media can often be used effectively to enhance retention and transfer: "Visual media can help learners to acquire retainable visual images, which are later used as sources of cues for retrieval of what has been learned" (p. 510). Results supported the findings showing that the most useful functions on the Web site were the use of pictures, tables, diagrams, etc. to recall or present new information. The importance of this function was revealed by results that showed that students' judgment of the instructional quality of the Web sites was lowest for functions that facilitated their abilities to provide a rich environment to explore the topics covered in the course syllabi, and to make use of the information on the Web site by synthesizing it in various assignments such as the use of Web site links. This function appears to be weakest in the sample course Web sites. The data in this study were not sufficient for further analysis. Further research is needed to identify strategies and functions that the WWW can utilize to support this instructional event.

6.4 Practical Implications

Three main dimensions were examined in this study, and practical implications are presented for each of the following: *Use (Time Spent), Instructional Quality* and *Usefulness*. Other related implications from the narrative data and the exploratory analysis are also included.

6.4.1 Practical Implications for Web site Use

The purpose of a course Web site is a main issue influencing use as indicated throughout the findings in this study from both the student and faculty surveys. Each course was designed by the faculty member with a different purpose in mind than the students, and this may have impacted the frequency of use and students' perception of the importance of the course Web site.

It appears that the more the course instructor relied on the course Web site as a resource, the more he/she encouraged students to use it and had higher expectations that the more students would use the site and have something to say about it in the narrative data. However, in all sampled courses, there was no obligatory use of the course Web sites, though some faculty made certain material available only through the course Web site. It is recommended that instructors think carefully about the purpose of the course Web site, to make serious use of it and to convey this message to their students. Putting material on the Web site and also handing it out in class serves only the few who miss class on a given day and sends mixed messages about the importance of the WWW. Students may assume that everything else on the Web site is also provided in class, as was the case with the History course in this study. As reported by the student who developed this site on the faculty survey, however, a lot of effort had gone into building the site and students were expected to have taken it more seriously. Incidentally, it also

received one of the higher rating on the WIDEC scale but received the lowest student ratings on the PURPOSE index for *Instructional Quality* (see section 6.7).

Earlier in section 6.4.2, it was reported that communication with experts was limited. Optimal use of the communication functions of the Internet to reach out to experts, authors, and peers in a global network was not found in any of the course Web sites. The future trend of communication is expected to make use of this capability and it is recommended that instructors provide their students with this opportunity and encourage them to use these resources. It was reported that students spent most of their time on the WWW, searching, downloading and printing. These functions are a waste of time unless the exercise is to randomly search the WWW. Why have a course Web site if an instructor wants his or her students to do unguided research using the WWW? It's like going to the library without a reading list. A course Web site should be designed to support students in reducing search time. In the narrative data, students found the course Web sites a better resource in comparison to going to the library *because* they pointed out that it cut down on search time. Second, why is downloading and printing rated high on the *Time Spent* dimension? Students should be interacting with the Web site, not converting online material to hard copies. Downloading is a bad sign, as it is cumbersome if having to read files in various formats (e.g. ADOBE™ or OFFICE™), time consuming if one has to obtain the necessary software, and costly in terms of printing.

Narrative data from student overall comments highlighted the above. A noticeable issue was the organization of the Web site. A well-organized Web site appears to facilitate access, saves unnecessary search time, and increases perceived

importance. A second issue was efficiency of use, especially related to costs. Students in every course commented in one way or the other about the "cost" of using the World Wide Web. Many students weighed the costs against the benefits, as did faculty members. Three issues dominated the open-ended statements: access, time, and content. For example, going to a computer cluster and the time it takes waiting in line for access to a computer terminal was weighed against the value of the information that was going to be obtained off the Web site. Others weighed the cost of time spent on the Web site in relation to the content itself in terms of its importance, relevance, timeliness, and currency. Still others weighed cost against the value-added brought about by the technology itself in terms of the unique access to specific information, the efficiency of downloading/printing, and the time saved in comparison to going to the library, for instance.

What is the solution? Optimize use of WWW multimedia capabilities by: providing well organized listings of sites worth visiting so as to reduce unnecessary search time; (b) re-creating documents utilizing more interactive formats that are engaging, not cognitively taxing, and provide a concise printable version; (c) increasing communications by designing the course Web site as a gateway to people networking by including listservs, chat rooms, and hypermail as a Web site function; and (d) making careful decisions about the purpose of the Web site, the relevance and importance of the materials and links. This last issue in particular is discussed further in the next section.

6.4.2 Practical Implications for Web site Instructional Quality and Usefulness

Earlier in section ??? visual displays emerged as a very useful feature of the Web sites. Visual displays were found to reinforce learning and present new information in

meaningful ways. Optimal utilization of visual displays emerged as a necessary discussion point, rating highly in terms of appeal and presentation of material. The capabilities of the course Web sites can be optimized by making appropriate use of various multimedia features using meaningful visual displays. Keller (1987a) identified three general categories to increase students' interest and dispel boredom: a) perceptual arousal; b) inquiry arousal; and c) variability. Perceptual arousal is a type of curiosity in which sudden and unexpected change in the environment activates a person's attention, such as a change in voice level or a surprise piece of information. In Web-based medium, animations, blinking text, use of humorous cartoons, and sounds are tools available for appropriate use. In the study sample, these tools are important, as evidenced in students' high ratings of visual appeal of Web sites as a mark of quality. This sharply contrasts with this authors' observation of the generally low WIDEC scores on the *Attention Gaining* component of the GAGNE scale.

Second, opportunities for communicating with faculty and teaching assistants to seek clarifications, ask questions, and receive feedback were perceived as most useful. These interactive functions represent Gagné's events pertaining to elicitation of information, guided practice, and feedback, and represent some of the seven principles of good teaching and learning. Course Web site design could be optimized to include these.

Third, of equal importance is the clarity of stating the purpose of the course Web site and connecting the various functions on the Web site. Similarly, specification of Web site functions to course goals and objectives on every given page on the site and not just an overall purpose and goal is also important and evidently needs to be improved on in this study's sample of Web sites. Students appreciated being informed about these

issues and this seems to have contributed to their perceptions of the importance of the course Web sites.

Fourth, students found visually appealing features of the course Web site to be useful in facilitating their recall of prior learning, presenting new information, providing learner guidance, and enhancing retention and transfer through enrichment and remediation functions. In sum, focusing on interactive, purposeful, and appealing functions in the design of course Web sites increases students' perceptions of their value as an instructional resource.

6.5 Methodological Implications

Even though the author has made an effort to try to make this study as methodologically sound and as generalizable to the intended student population as possible, there are some issues that should be discussed at this time. The first one involves not accounting for all the variability of the nine course Web sites in terms of instructional design, teaching strategies employed, content, context, and purpose. While a faculty survey was employed in this study, it took into account only the purpose of the course Web sites. Furthermore, all course Web sites, but one, were designed and developed by faculty and student assistants without using a shared Web site template or consulting with each other on any specific standards. The author was informed that within this group, some faculty members used one or two Web sites as models for their own. The faculty survey indicated that course Web site design was based on general perceived student needs, expectations, and out of an innovative spirit[17]. It is important to

[17] ECN200 faculty questionnaire was not returned therefore no major conclusions are drawn regarding this course without faculty perspective.

note that, as Clark (1983, 1994) has argued, the use of instructional design as an instructional intervention has a larger impact on learning than the technology itself. While the Web site selection instrument (WIDEC) served to provide some benchmarks for making comparisons based on instructional design criteria in this study, the study could be extended by taking into account the variables listed above in future research.

Second, students' perceptions may have been influenced by their own learning styles, instructors' teaching styles and the instructional methodologies applied to the course Web site design among others. Already, the narrative data provides some support for this contention, as two students indicated that their course Web sites were a reflection of their instructor's teaching style, with its strengths and limitations. This study focused on the perceptions of students. It is necessary to acknowledge that perception data is only the first sequence of information needed to evaluate a new medium of instructional delivery. There are several other areas as noted by Philips (1996) - namely specific learning, transfer to other application domains, measurable results and return on investment. However, since this was beyond the scope of the study, these issues are not discussed but could be controlled for in future studies.

A third issue involves further instrument validation and reliability testing, specifically the Web site Instructional Design Evaluation Checklist (WIDEC) and the Student Web site Perception Survey (SWPS) which were developed by the author. Replication is necessary to provide further evidence regarding reliability and validity under different contexts and with larger sample sizes. While factor loadings of items and Cronbach's coefficient Alpha levels were high for SWPS, replication is necessary for further establishing the integrity of the instrument. Similarly, while high interclass

correlations were obtained for WIDEC, replication of WIDEC and measures of its reliability over time, with different groups, are recommended.

A fourth issue is the actual bias and constraints in the selection of a theoretical framework to guide the study. On the one hand, this serves to narrow the scope of the study and provides the necessary grounding for study results and findings. On the other hand, this limits the authors' epistemological and philosophical approach to the study. For example, Gagné' s work emerged from a behavioristic and cognitivist approach to instructional design. Embracing this approach excludes the discussion of other theoretical approaches derived from cognitivism, constructivism, and post-modernisim. The author acknowledges the importance of contributions made by these alternative theoretical perspectives, but limits the study to a focus on systematic instructional design. The study contributes to fostering and supporting meaningful learning as cited earlier from Khan's definition (1997); specifically "Web-based instruction (WBI) .....utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is *fostered and supported* [italics added]" (p. 6). This approach was embraced because the goal of the study is to generate findings that focus on providing support for the design of instruction in a Web-based environment. Future design could utilize other theoretical frameworks to guide elicitation of student perceptions to accomplish additional research goals.

Moreover, the author acknowledges that the survey questions may have focused students' responses on a given viewpoint rather than explored their perceptions without any prior suppositions. For example, a more constructivist approach to the design of the study might have used observations, interviews, and case study methodologies that would

allow for elicitation of other issues of importance to students that were missed in this study. Nonetheless, an argument could be made for any choice of theoretical underpinnings made in terms of their relative advantages and disadvantages. Therefore, the above constraints were deliberately imposed by the author, as a means for not only narrowing the scope and guiding the study, but also because the author believes that the theoretical approach to the study lends itself to empirical application in a Web-based context. Thus, both the nine events and the seven principles merit testing their validation and utility in this new context. In addition, the author believes that the incorporation of two theoretical frameworks in one study was too ambitious an effort and recommends that future studies focus on further development of the instruments using one framework at a time.

Finally, the extent to which the design of the study served to better explain the phenomenon of study is a central issue of this section. The survey served to take a snap shot in time of a rapidly changing and growing event. Even the narrative data served the same purpose. While the author does not question the choice of methods, she does posit the question of how to better study the phenomena given its evolving nature. Cross-sectional studies can only provide "snapshots in time" (Pedhazur & Schmelkin, 1991) that once taken no longer accurately represent the state of affairs. Longitudinal studies may better inform researchers of the capabilities of the medium and its optimal use for supporting teaching and learning practices.

6.6 Future Research

At the conclusion of this dissertation study, the research has identified several areas for future research. These areas will not only help to support or refute findings of this study, but they will also assist in furthering the knowledge base of information in this area of using the World Wide Web as an instructional resource, be it for campus-based traditional education or Web-based instructional design in general.

1. Replicate the study with a sample of more sophisticated instructional Web sites that rank high on the WIDEC scale and include more of the nine events than this sample.
2. Narrow scope of study and replicate the dissertation study for each dimension separately with a more rigorous design of the student instrument to include more items for each dimension.
3. Conduct further analysis specific to the constructs that emerged from this study. It would be interesting to replicate the study with a different student population and determine the extent to which similar constructs emerged from the factor analysis. Qualitative data collection methods may then be employed to further our understanding of why these constructs emerged instead of others.
4. Extend the development effort of the instruments used in the study WIDEC, SWPS, and the faculty survey to generate more rigorous indicators that serve the statistical analysis process but also extend the implications for instructional design application to Web-based design. WIDEC could be extended to include more Web site functions and unique aspects of course Web sites. SPWS could benefit from a more rigorous development of items representing the various constructs drawn from the nine events and the seven principles of good teaching and learning practices, particularly principles that were not well addressed in this study. Identifying more Web site

functions leads to further understanding of how to optimize the use of the WWW for good teaching and learning practices. The faculty survey could become more beneficial if extended to elicit data not only on the purpose of the course Web sites but also on the instructors' teaching strategies, course requirements, and other relevant variables.

5. Conduct a study on the faculty perceptions of the usefulness of course Web sites to identify the extent to which this medium is facilitating good teaching practices.
6. Explore student demographic and characteristics within a given context as possible influential factors on students' perceptions, particularly residential proximity to campus, GPA, attitude, and variations among courses for possible insights into optimal use of the technology to better meet students' academic needs.
7. Explore possible influence of field-based and knowledge-based subject areas on students' perceptions of the usefulness of the course Web site. In this study, there is evidence that the applied science courses were ranked higher than their art sciences counterparts in terms of purpose in particular and overall perceived usefulness as supported by the narrative data.

6.7 Conclusions and Recommendations

In sum, the World Wide Web is here to stay as evidenced by the increasingly prevalent use of WWW technology to further enhance the traditional teaching model in mainstream higher education. Further evidence can be found in the ever-growing numbers of online courses, course Web sites, and online learning networks. Recommendations for instructional design and WWW technology integration efforts should take into consideration first and foremost the barriers to use. Access, improved

student Internet skills, increased student motivation and efficient and effective use of time are crucial to the success of WWW integration efforts. Similarly, improving access to the Internet, designing Web sites that make efficient use of students' time on task by optimizing the capabilities of the WWW particularly on navigational and organizational functions will further enhance integration. Establishing and maintaining conducive and facilitative conditions to implement effective teaching and learning practices, from a student-users' perspective, necessitates provision of sufficient guidance, the availability and accessibility of useful content, and increased facilitation of communication as necessary conditions to successful integration.

The World Wide Web still offers unexplored potential and opportunity to enhance learning by becoming a valuable support tool for campus-based courses. This will certainly become even more evident as the student population continues to change and universities strive to accommodate and adapt to students needs and seek to improve the quality of teaching and learning practices using technology as a lever. This chapter has provided some guidelines for designing useful course Web sites based on empirical findings contributed by the study of nine course Web sites from a range of disciplines, used by 142 students representative of Syracuse University students. The findings may be generalizable to students at Syracuse University and to students of similar demographics and characteristics as SU students studying in U.S. higher education institutions. However, the characteristics of the course Web sites and the purposes for which they were designed are factors that may not be generalizable as there is unaccounted for variance amongst each other and in comparison to other WWW sites.

Therefore, this study may in this manner be considered a case study of one large private institution's efforts to integrate WWW technology into the classroom.

Finally, if one sentence were to capture the major findings of this study it would be that a mark of quality and usefulness of a course Web site, from a student perspective, is that it is appealing, purposeful, and encourages non mandatory use, free explorations, and self-directed learning. The following are the author's recommendations for optimization of using course Web sites as an instructional resource to make them more appealing, purposeful, and motivating to students, bringing this report to a close:

1. Identify the purpose of your course Web site and convey that purpose to your students by relating it to the course purposes and goals.
2. Specify the purpose and expectations for each segment of your course Web site and relate those to the course, unit, or session objectives.
3. Utilize the visual display capabilities of the medium to increase appeal.
4. Reduce the need for downloading and printing.
5. Utilize WWW features to facilitate cognitive learning strategies as suggested.
6. Utilize multimedia presentations to present material that can take up much of class time in note-taking and introductions. This frees up class time for discussions, analysis, questions and clarifications of the presentations that students reviewed on their course Web site.
7. Your attitude towards the importance of the course Web site, its relevance to class, and its utility as a resource, influences students' perceptions of its quality and usefulness, and the overall use of the course Web site.

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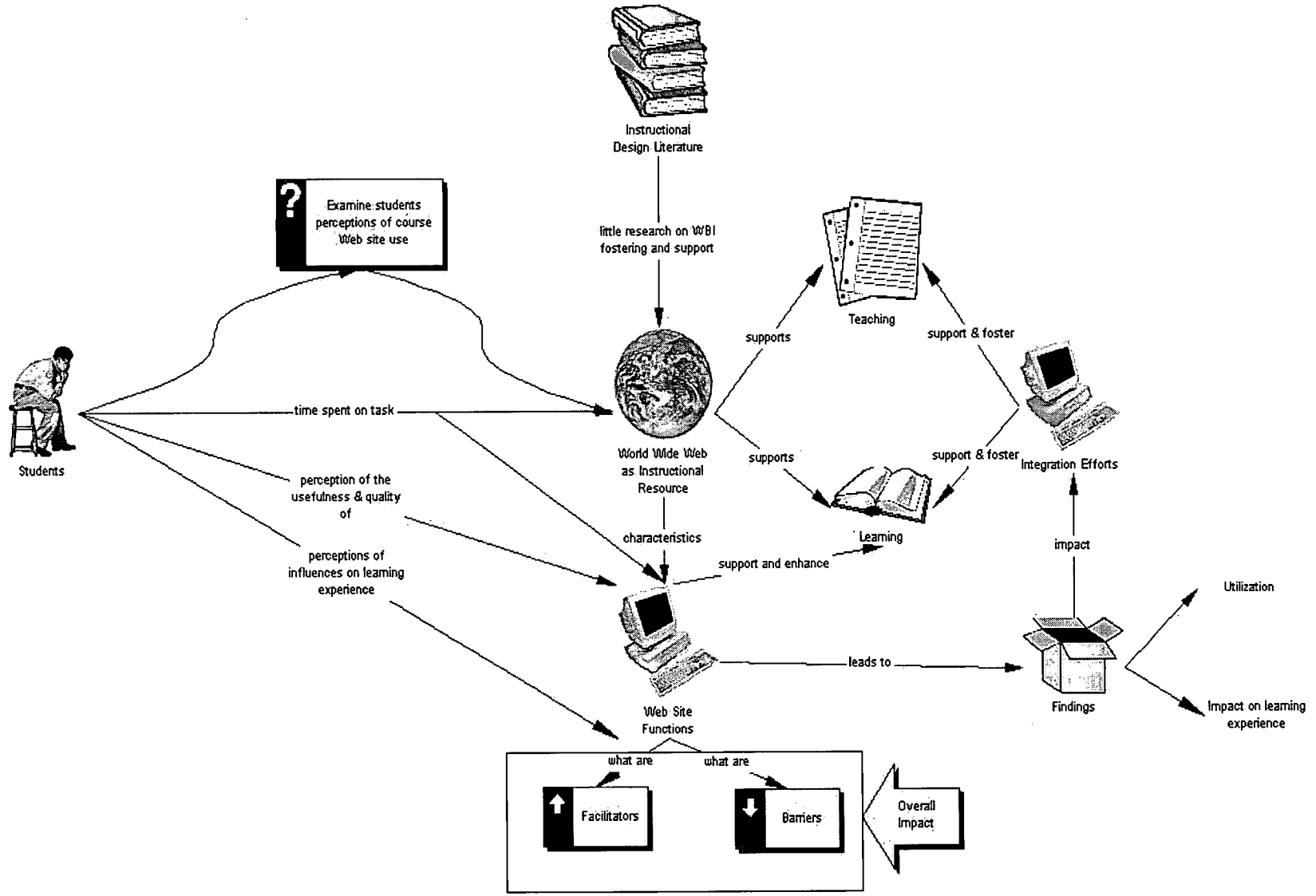
Figure C A Bird's Eye View of the Study (Courtesy of Gerald Edmonds, PhD.)



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A Pearson' Product Intercorrelation Matrix for Indexes for Perceived Time Spent, Quality, and Usefulness, Demographics and Characteristics (significant at $p<0.05$)

	Age	GPA	Class	Years	Foreign	Proximity	Reason	Distance	Interact	Purpose	Appeal	Guide	Prepare	Attitude	Skills
Age	x	-	0.57	-0.18	-	0.42	-	-	-	-	-	-	-	0.18	-
GPA		X	-	-0.28	0.33	-0.26	-	-	-	-	-0.20	-	-	-	-0.22
Class			x	-	-	0.64	-	-	-	0.18	-	-	0.19	0.27	-
Years				x	-0.22	-	-	-0.33	0.21	-	-	-	-	-	0.29
Foreign					x	-	0.22	-	-0.18	-	-	-	-	-	-0.18
Proximity						x	-	-	-	-	-	-	-	0.23	-
Reason							x	-	-	-	-	-	-	-	-
Distance								X	-	-	-	-0.27	-0.39	-	-
Interact									x	-	-	-	0.33	-	0.24
Purpose										x	-	0.33	-	0.44	-
Appeal											x	0.24	0.52	0.40	-
Guide												x	0.52	0.32	-
Prepare													x	0.52	-
Attitude														x	-
Skills															x

Foreign = American vs Non-American students
Zero correlation for Sex, Modem Speed, and Type of Network Connection

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